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Bayou Segnette Waterway Dredged Material Placement Study Preliminary Assessment

Summary of Findings and Recommendations

Glenn M. Suir, Candice D. Piercy, and James B. Johnston

March 2013



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Summary of Findings and Recommendations

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Final report

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Abstract

The Bayou Segnette Waterway (BSWW) has a history of shallowness due to shoaling and consequently requires periodic dredging to maintain its navigability. However, traditional dredged material placement sites along the BSWW are either at or near capacity. Therefore, this study set out to identify viable options for future maintenance dredging and recommend innovative methods of transport and placement of material dredged from the BSWW. The approach of this study was to characterize existing conditions of the waterway and nearby landscapes, as well as to inventory dredge history information (past and future volumetric estimates of the channel and placement area capacities).

The landscape analyses performed as part of this study consist of land change, habitat, and elevation assessments. The majority of the landscape surrounding the BSWW is highly stable, but does contain viable shallow-water areas for beneficial use applications. The BSWW area consists of comparatively healthy attached and floating fresh marsh. Floating landscapes provide opportunities for applying relatively novel dredged material placement applications, especially in areas where placement capacities are limited. Additionally, the BSWW area consists of elevations that are lower than those ideal for fresh and intermediate marshes. Adding sediment to floating and attached marshes within the BSWW project area could potentially provide elevation and nutrient benefits to those areas. The BSWW area has adequate placement capacity for the volume of material to be dredged, assuming thin-layer placement on floating marsh is a viable placement option, and estimated capacities at identified wetland sites are reasonable.

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Preface

The work reported herein was conducted at the U.S. Army Engineer Research and Development Center (ERDC), Vicksburg, MS. The research documented in this report was conducted for and funded by the U.S. Army Corps of Engineers, Mississippi River Valley Division, New Orleans District, New Orleans, LA.

This report was prepared by Glenn Suir, Dr. Candice Piercy, and Dr. James Johnston of the ERDC Environmental Laboratory (EL), Vicksburg, MS. The authors would like to thank the following individuals for their technical guidance and/or report review: Jeffrey Corbino of U.S. Army Corps of Engineers, New Orleans District; Haigler Pate of the National Park Service; Dr. Charles Sasser of the Louisiana State University; Dr. Christopher Swarzenski of the U.S. Geological Survey; and Christina Saltus, Sam Jackson, and Dr. Paul Schroeder of the ERDC-EL.

This study was conducted under the direct supervision of Mark Graves, Branch Chief, Environmental Systems Branch (EE-C) and Dr. Edmond J. Russo, Jr., P.E., Chief, Ecosystem Evaluation and Engineering Division.

At the time of publication of this report, Dr. Beth Fleming was the EL Director, COL Kevin J. Wilson was Commander of ERDC, and Dr. Jeffery P. Holland was Director of ERDC.

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1 Purpose and Scope

The Bayou Segnette Waterway (BSWW) has a history of shallowness due to shoaling, and therefore requires periodic dredging to maintain its navigability. However, previously identified dredged material placement areas are insufficient for maintenance of the entire waterway's length. These insufficiencies are primarily due to a combination of factors, including environmental concerns, transport costs, and limited capacity within previously identified placement areas. Therefore, the primary purpose of this study was to identify sites with adequate capacity and that are technically viable for the placement of materials that will be dredged during maintenance of the BSWW. The approach of this study was to use a combination of wetland science, dredging research, and geospatial analyses to characterize existing conditions of the waterway and nearby landscapes, to inventory dredge history information (past and future volumetric estimates of the channel and placement site capacities), and to recommend innovative methods for the excavation, transport, placement, and containment of dredged materials.

The scope¹ of work includes (1) reviewing all dredging history of the waterway; (2) using recent hydrographic survey data to map the locations and quantities of channel shoaling; (3) performing comprehensive mining and analyses of all essential geospatial data to characterize historical and current landscape conditions and trends; (4) performing GIS-based analyses and volumetric estimates to identify the extent of existing placement areas, and inventory residual placement site capacities; (5) using land- and habitat-change analyses to identify new potential placement locations and associated volumetric capacities; (6) determining suitability of the dredged material for potential beneficial use for wetland restoration and nourishment; and (7) recommending innovative methods for the excavation, transport, placement, and containment of dredged materials.

¹ The scope does not include analysis of ancillary operational dredge planning and design considerations under Federal requirements, such as layout of dredging engineering design features, cultural resources survey, proximity of existing structures, real estate boundaries, etc.

2 Introduction

2.1 Project Description

The River and Harbor Act of 1954 provided authorization to the U.S. Army Corps of Engineers (USACE) to construct and maintain the 12.2 mile (19.6 kilometers) long Bayou Segnette Waterway (BSWW; Figure 1). The authorization provides for a channel 9 ft (2.74 meters) deep and 60 ft (18.29 m) wide at Mean Low Gulf (MLG) from Company Canal at Westwego, Louisiana, to the Gulf Intracoastal Waterway (GIWW) via Bayou Segnette, a land cut, and Bayou Villars. An interim channel 8 ft (2.44 m) deep by 80 ft (24.4 m) bottom width (6 ft (1.83 m) plus 1 ft (0.3 m) of advanced maintenance and 1 ft (0.3 m) of allowable over-depth) was completed in June 1957.

This project follows a route from the headwaters of Bayou Segnette, extending south through the BSWW, and discharging at the confluence of the Intracoastal Waterway and Barataria Bay Waterway. Due to the existing shallowness, and continued shoaling of the waterway, maintenance dredging is required for watercraft navigation along the BSWW. This study serves to identify placement options associated with dredged material from the BSWW that are technically viable and within limitations of the Federal Standard. Coordinating with other Federal, state, and local partners allows for the avoidance of cross-programmatic conflicts, and promotes synergism for regional and system-based planning.

2.2 Project Area

The BSWW is located within the Jefferson parish region of the Barataria watershed basin - approximately six miles (9.66 km) southwest of New Orleans, Louisiana (Figure 1). The majority of the BSWW is located within the Jean Lafitte National Historical Park and Preserve (JLNHPP). When navigable, this waterway provides a route from the GIWW by which recreational and commercial fishing fleets can reach the Barataria Bay Waterway, Bayou Lafourche, and ultimately the Gulf of Mexico. To ensure all potential placement sites were evaluated, and to simplify the area of analysis, the JLNHPP boundary was expanded to include all reaches of the BSWW, all logistically viable placement sites, and all contiguous areas between Lakes Cataouatche and Salvador, the Lake Cataouatche and

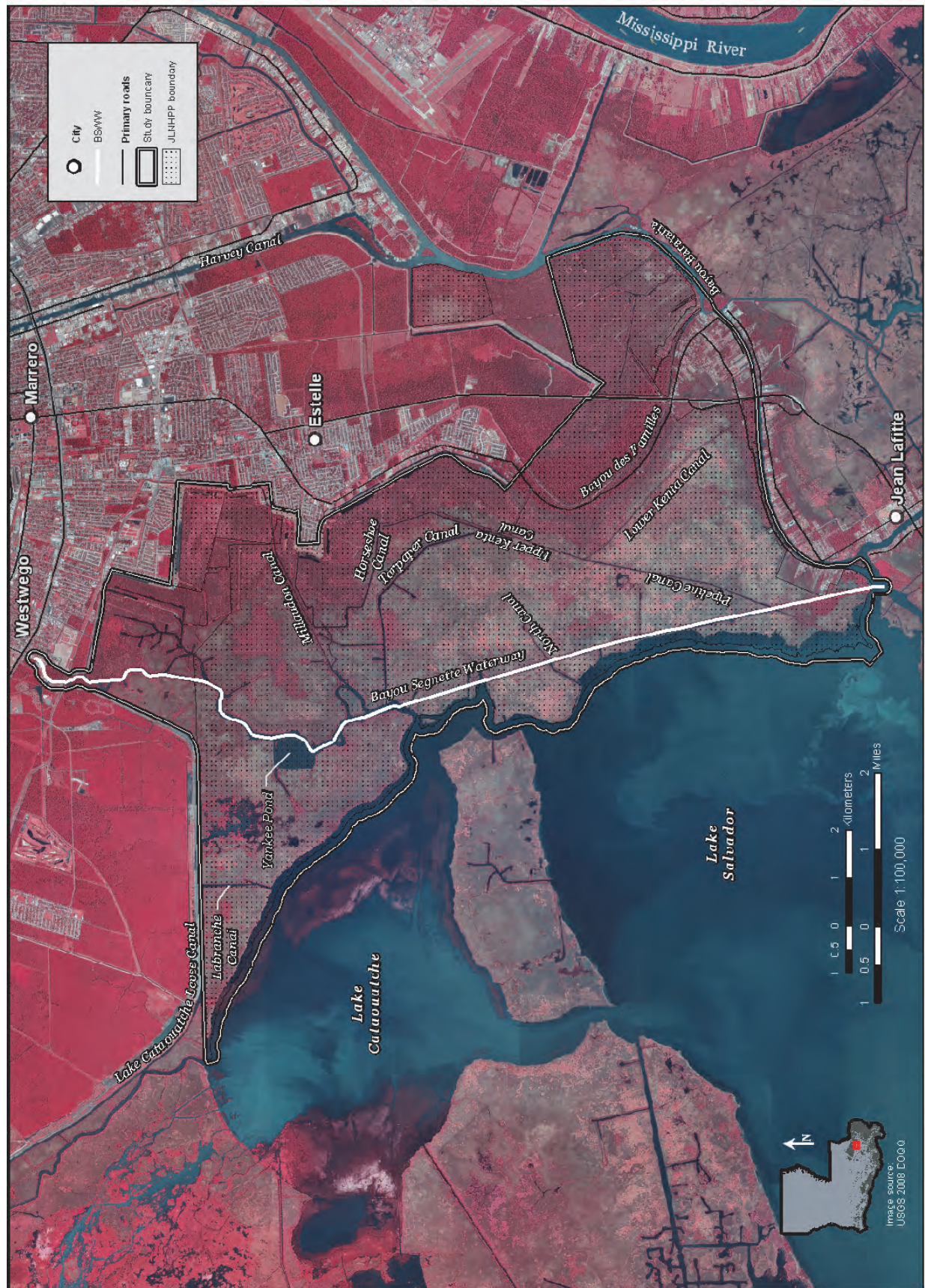


Figure 1. Bayou Segnette Waterway (BSWW) location map.

Westwego to Harvey Canal levees, and Bayou Barataria (Figure 1). To simplify the landscape assessments, volumetric estimates, and computations of channel and placement capacities, the BSWW system was divided into twelve channel reaches that are delineated by waterway mile locations (Figure 2).

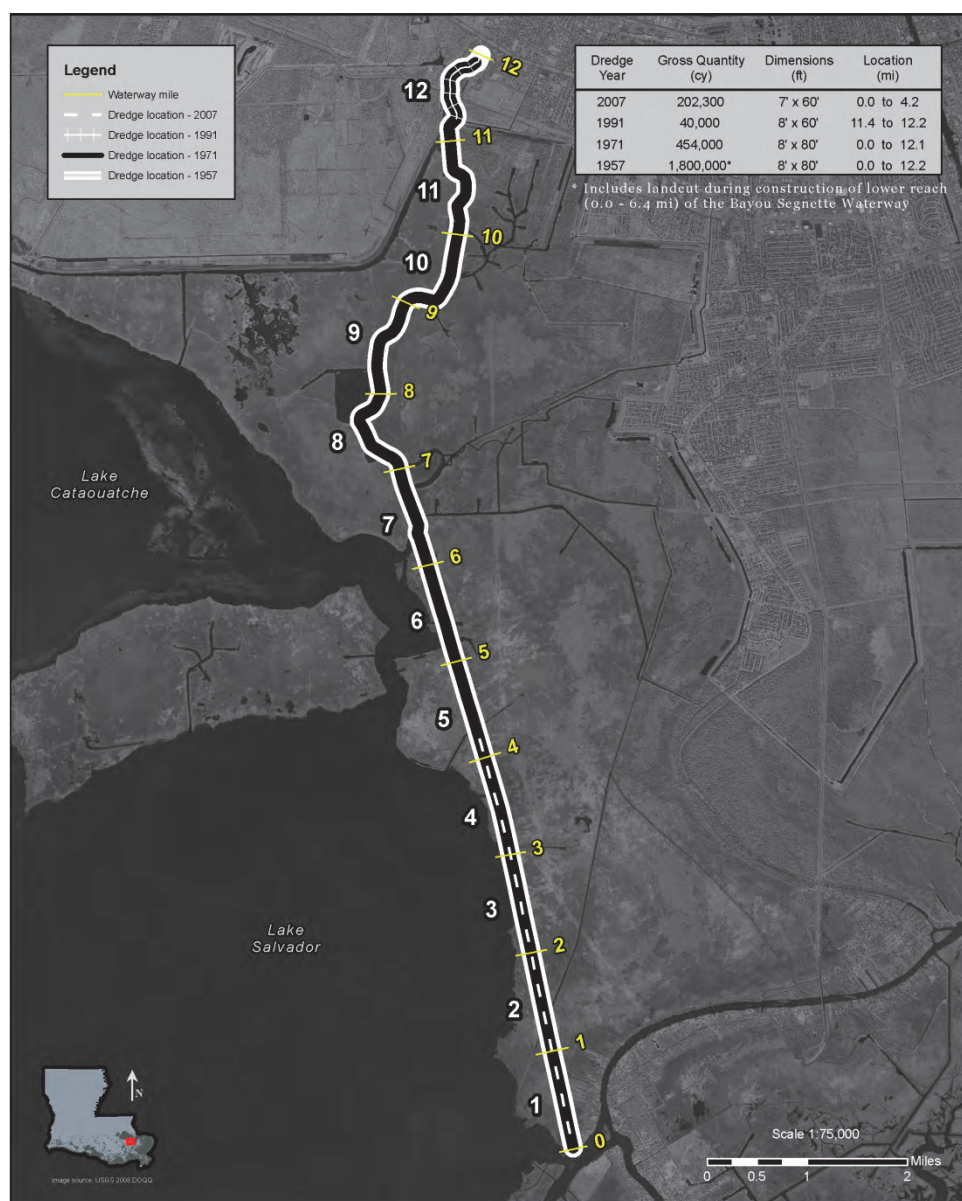


Figure 2. The Bayou Segnette Waterway reach (white annotation), waterway miles (yellow annotation) and maintenance dredging locations, dimensions, and quantities.

2.3 Dredging History

Figure 2 identifies the dredging locations (by waterway mile), and the following table (Table 1) provides a summary of all dredging events in the

BSWW (natural and channelized reaches) from year 1948 to 2007. Historically, this channel has required maintenance dredging approximately every 15 years (USACE 1976), though some events have consisted of partial dredging of the waterway. Maintenance of the channel has consisted of removing shoal material by way of hydraulic and bucket dredges. In areas where bucket dredging was performed, the dredged material was placed along the banks of the bayou, at a minimum distance of 50 feet (15.2 m) from the waterway. Since portions of the BSWW contain fluid shoal material that does not stack well, hydraulic dredges have been used. Where hydraulic dredging was performed, dredged material was placed within diked land areas and the effluent was returned to the BSWW. Since hydraulic dredges are not capable of excavating exactly to the authorized project dimensions, authorized over-depth dredging provided a tolerance limit to dredgers for achieving at least the authorized dimensions.

Table 1. Bayou Segnette Waterway dredging from 1948-2007.

Contract (No)	Gross Quantity (cy)	Dimensions (ft)	Location (mi)	Disposal Site	Contract Completion Date
06-C-0209	96,300	7' x 60'	0.0 to 1.6	DA #2	2007
06-C-0209	6,000	7' x 60'	0.0 to 1.6	DA #3	2007
06-C-0209	100,000	7' x 60'	1.6 to 4.2	DA #4	2007
90-C-0093	40,000	8' x 60'	11.4 to 12.2	DA #1	1991
71-227	454,000	8' x 80'	0.0 to 12.1	-	1971
-	1,800,000*	8' x 80'†	0.0 to 12.2	Spoil Bank	1957
-	-	8' x 50'	7.9 to 11.9‡	-	1951
-	-	6' x 40'	6.4 to 12.2‡	-	1948
Annual Average: 41,800 Cubic Yards					

* Includes land cut during construction of lower reach (0.0 - 6.4 mi) of the BSWW.

† Six feet plus 1 foot of advanced maintenance and 1 foot of allowable over-depth.

‡ Revised to match current configuration of the BSWW.

Prior to the construction of the BSWW in 1957, maintenance dredging was performed on two occasions within the natural reaches of Bayou Segnette. The BSWW interim channel, 8 feet deep by 80 feet bottom width (6 feet plus 1 foot of advanced maintenance and 1 foot of allowable over-depth), was completed in 1957. This channel consisted of a new land cut along the eastern shore of Lake Salvador from mile 0 at the GIWW to mile 6.4, thence enlargement and realignment of Bayou Segnette from mile 6.4 to mile 12.2

at Company Canal (Figure 2). Post-construction maintenance dredging was performed on three occasions along the BSWW. Each dredging event removed varying quantities of shoal material from the BSWW. Maintenance dredging was performed in 1971 from mile 0 to mile 6.4 using a bucket dredge, and from mile 6.4 to mile 12.1 using a hydraulic dredge. Partial maintenance dredging of the BSWW was also performed in 1991 from mile 11.4 to mile 12.2, and from mile 0 to mile 4.2 in 2007.

3 Dredged Material Volume and Quality

3.1 Historical Dredged Material Quantities

The quantities represented and discussed in this study are the gross quantities dredged from the waterway. Table 1 identifies the gross quantities, dimensions, locations, and dates of all previous maintenance dredging activities along the BSWW. Dredged quantities from those maintenance events that occurred prior to the construction of the BSWW are unknown. The 1957 enlargement and realignment of the BSWW (0 to mile 12.2) removed approximately 1,800,000 cubic yards (CY) of material via dredging of existing reaches and a new land cut. The 1971 maintenance dredging removed approximately 450,000 CY from the entire length of the waterway (0 to mile 12.1). The partial dredging activities in 1991 (11.4 to mile 12.2) and 2007 (0 to mile 4.2), removed approximately 40,000 and 202,300 CY of material, respectively.

3.2 Existing Shoal Material Quantities

Existing grades in the BSWW range from El. -2 to -7 ft MLG. The material requiring dredging has an average thickness of 3 ft (Figure 3; Mathies and Russo 2003). Recent surveys (Appendix Figures A1-A8), and subsequent analyses (Table 2), estimate the quantity of current shoal material at approximately 532,000 CY. These assessments were performed using hydrographic survey data (2010) to compute shoaling quantities above an assumed -8 ft MLG by 80 ft trapezoidal channel with 3:1 side slopes. The by-reach quantities range from 18,631 CY (for reach 2, which was last dredged in 2007) to 75,620 CY (for reach 8, which was last dredged in 1971). Based on volumetric estimates, and previous shoaling and dredging frequency and extent, approximately 600,000 CY of material will require removal at a frequency of every 15 years. These proposed dredge cycles are based on annual averages and best professional judgment (Tables 1 and 2).

3.3 Dredged Material Characterization

A thorough analysis of the BSWW sediments was conducted in 2001 (PBS&J 2002). Sediment samples were collected every mile along the BSWW and analyzed for solids content, carbon content, particle size, and potential toxins such as metals, pesticides, PAHs, and semi-volatile



Figure 3. Shoaling thickness (above -8.0 mean low gulf) within the Bayou Segnette Waterway.

Table 2. Bayou Segnette Waterway shoal quantities computed using 2010 hydrograph survey data (Appendix A).

Reach	Mile	Volume (cubic yards)
1	0-1	27,592
2	1-2	18,631
3	2-3	20,764
4	3-4	27,248
5	4-5	27,036
6	5-6	41,337
7	6-7	60,458
8	7-8	75,620
9	8-9	75,071
10	9-10	60,062
11	10-11	58,216
12	11-12	40,290
Total	0-12	532,325

compounds. For sediments free of constituents of environmental concern, organic matter content and particle size distribution are essential in determining possible uses of the sediments. The BSWW was free of most constituents of concern apart from increased concentrations of PAHs at mile 12 near Westwego, Louisiana. The physical properties of the BSWW sediments are summarized in Table 3. The BSWW sediments are oligohaline and fine-grained. The solids portion of the sediments is approximately 25% total organic matter by weight, assuming organic matter is 56% carbon. The mineral sediment is a mixture of clay and silt at a ratio of 1.6:1. This mixture is suitable for environmental enhancements, including wildlife habitat and wetland restoration, agricultural uses and products such as topsoil, land improvements, and – if adequately protected from erosive forces – land creation (Brandon and Price 2007).

Comparatively, the majority (85.7 percent of the total soils area: 18,661 of 21,772 acres) of soils present within the BSWW project area are characterized as hydric muck soils. The project area primarily consists of Kenner (11,598 ac), Barbary (4,450 ac), and Allemands (2,516 ac) mucks, and the Schriever (2,225 ac) clay series. The parish-wide range for organic matter within these muck soils is 30 to 60 percent (NRCS 2009). Studies show that

project area soils have organic matter that ranges from 44 to 87 percent, with stream side areas and those not behind "spoil" banks as having lower organic matter content than those at inland locations (Taylor et al. 1989, and Holm et al. 2000).

Table 3. Summary of the Bayou Segnette Waterway sediment physical properties.

Location	Salinity (%)	Solids by weight (%) (wet basis)	Solids by volume (%) (wet basis)	Organic matter by weight (%) (dry basis)	Clay by weight (%) (dry basis)	Silt by weight (%) (dry basis)
Mile 0	0.4	28.6	15.6	15.9	67.5	32.5
Mile 1	0.7	26.4	14.5	17.9	53.5	46.5
Mile 2	0.6	22.3	13.1	27.9	28.0	72.0
Mile 3	0.6	17.7	11.1	38.9	40.6	59.5
Mile 4	0.6	23.9	13.3	20.9	32.9	67.1
Mile 5	0.6	24.8	13.6	19.3	51.4	48.6
Mile 6	0.6	16.7	10.0	33.8	33.5	66.5
Mile 7	0.6	21.3	11.8	23.0	49.0	51.1
Mile 8	0.6	22.6	12.8	24.3	49.3	50.7
Mile 9	0.6	13.8	8.8	43.2	25.0	75.0
Mile 10	0.6	19.6	11.3	27.5	25.9	74.1
Mile 11	0.6	26.0	14.2	18.0	42.1	57.9
Mile 12	0.4	24.3	13.2	18.3	46.4	53.6
Average	0.6	22.1	12.6	25.3	41.9	58.1

4 Historical Placement Areas

All BSWW-related dredging, design, and National Environmental Protection Act (NEPA) documents were acquired and used to identify historical placement areas. Dredged material placement along banklines and in confined dredged material containment facilities have been the methods used in conjunction with previous BSWW maintenance dredging. Appendix Figures B1-B12 identify the location and quantities of material deposited during the construction and maintenance dredging of the BSWW (1957, 1971, 1991, and 2007). The Bayou Segnette Waterway, Louisiana, Design Memorandum No. 1 (USACE 1956) and the Bayou Segnette Waterway and Barataria Bay Waterway Final Environmental Impact Statement (FEIS; USACE 1976) identify the same outer limits of impact of dredged material placement for the 1957 enlargement and realignment of the waterway and 1971 maintenance dredging event, respectively (Appendix Figures B1-B12). Though these general areas of impact are identified, no as-built drawings or final engineering reports were procured; therefore, the specific reach-wise volumes and placement areas are not known. However, the 1976 FEIS does provide general descriptions of the maintenance dredging and placement practices. This FEIS states that banks on the eastern side of the bayou that were formed during maintenance dredging in 1971, were vegetated by *Salix nigra* (black willow), *Triadica sebifera* (Chinese tallow), and *Ambrosia trifida* (giant ragweed). The dredging events of 1957 (1,800,000 CY) and 1971 (454,000 CY) created higher elevation "spoil" bank deposits. These higher elevation features have served as a substrate for dense vegetative cover (arboreal canopy plus a variety of shrubs, vices, and herbaceous vegetation; USACE 1976), and permanent and seasonal camps. Utilizing existing "spoil" bank areas for future placement of dredged material is problematic since the mid- and upper-reaches of the waterway are lined by camps and other structures, and the material within the lower-reaches is fluid and not suitable for stacking. Additionally, increasing the elevation of these "spoil" banks will further restrict the natural hydrology and function of the ecosystem. All non-"spoil" bank areas (marsh, swamp, and shallow open water) that were previously authorized for placement during the 1957 and 1971 construction and maintenance events should contain viable capacity and therefore be considered for future maintenance dredging.

The 1991 maintenance dredging and materials placement practices consisted of upland confined disposal. In the 1989 Bayou Segnette

Waterway, Louisiana, Maintenance Dredging Environmental Assessment (EA; USACE 1989), two dredged material placement sites were identified for use: a previously authorized placement site of approximately 14.2 acres of swamp on the west side of the bayou (near waterway mile 11.4) and a newly proposed abandoned canal within an approximately 30.0 acre placement area on the east side of the bayou (Appendix Figure B12). Though canal reclamation was the preferred plan, the local assuring agency was unable to gain the right to use the canal from the landowner, and the 14.2 acre swamp site was used for placement of approximately 40,000 CY (10 inch depth post-dewater and desiccation) of dredged material. Light Detecting And Ranging (LiDAR; USACE 2008) data show that the bare earth elevations for the 14.2 acre swamp site are predominantly below +1.6 ft North American Vertical Data of 1988 (NAVD-88; see description of ideal marsh elevation below), with a higher elevation berm (ranging from +2.0 to +3.0 feet; NAVD-88) along the eastern bank. With adequate containment, this site could provide serviceable capacity and therefore should be considered a viable placement option for future maintenance. Additionally, if land rights are acquired for the use of the canal that was previously proposed in the 1989 EA, the canal reclamation and flowage option could provide placement opportunities in the limited capacity reaches along the upper BSWW.

The 2007 maintenance dredging and materials placement practices consisted primarily of wetlands development and upland confined disposal. Three placement sites were identified and utilized during the 2007 maintenance dredging of the BSWW (Appendix Figures B1-B3). Disposal Areas (DA) #2 and DA #3 received approximately 96,000 CY and 6,000 CY of the material excavated from mile 0 to mile 1.6, respectively. DA #4 received approximately 100,000 CY of material from mile 1.6 to mile 4.2. The Bayou Segnette Waterway Entrance "Y" section was also dredged as part of the 2007 maintenance. Of the approximately 88,900 CY of material dredged, 73,900 was pumped to DA #1 and 15,000 to the Villars placement area (Appendix Figure B1). The elevation of DA #1, DA #2, DA #3, and the Villars placement areas are in the optimal range for wetland/swamp landscapes, and therefore could only receive minimal amounts of dredged material. Since the 2007 maintenance event, DA #4 has received additional dredged material from a separate shoreline protection project. This site is near its capacity, and therefore not a viable option for near-term placement of dredged material (based on West Closure Complex project post construction site visit and photography).¹

¹ Personal Communication. Jeffrey Corbino, 2012, Baton Rouge, LA, U.S. Army Corps of Engineers.

5 Proposed Placement Areas

5.1 Landscape Assessments

As with recent maintenance, future dredging of the BSWW to the interim and authorized depths is complicated by the shortage of available areas required for dredged material placement. Landscape analyses were conducted to assist in the identification of sites suitable for the placement of dredged material. Those analyses include the assessments of land-water classified imagery, wetland vegetation, and elevation to characterize the existing conditions and trends of landscapes within the BSWW project area.

5.1.1 Landscape

Figure 4 depicts land change within the BSWW study area for the overall period of analysis (1956-2008). The majority of land loss during this period is due to Lake Salvador shoreline erosion and wetland erosion within the blowout area between Yankee Pond and Labranche Canal. The encroachment of Lake Salvador upon the BSWW has increased the potential for erosive forces and higher salinity waters to reach the freshwater marshes of the JLNHPP. In 1994, the lake shoreline was reinforced with rocks to reduce the exchange of water between the lake and BSWW, and to protect the interior marshlands of the park from lake associated erosive effects. Relative to land loss within the Barataria basin, and with the exception of the erosional areas listed above, the BSWW project area landscapes are highly stable. Due to this stability, the land change assessments performed as part of this study identified only four primary areas for placement site consideration (Lake Cataouatche Levee Canal blowout area, Yankee Pond, Lake Salvador shoreline including the Lake Salvador Wetlands Creation site, and numerous oil and gas access canals; Figure 4).

5.1.2 Habitat

Habitat assessments (switching and change trends) are useful indicators for evaluating habitat conditions, and identifying potential sites for dredged material placement. The placement of dredged material in areas that are experiencing declining habitat conditions is an improvement action that can enhance aquatic, wetland, and floodplain habitats. Some vegetation, such as floating and sub-aquatic vegetation, are sensitive to the quality, quantity, and application of dredged materials. The majority of non-forested and

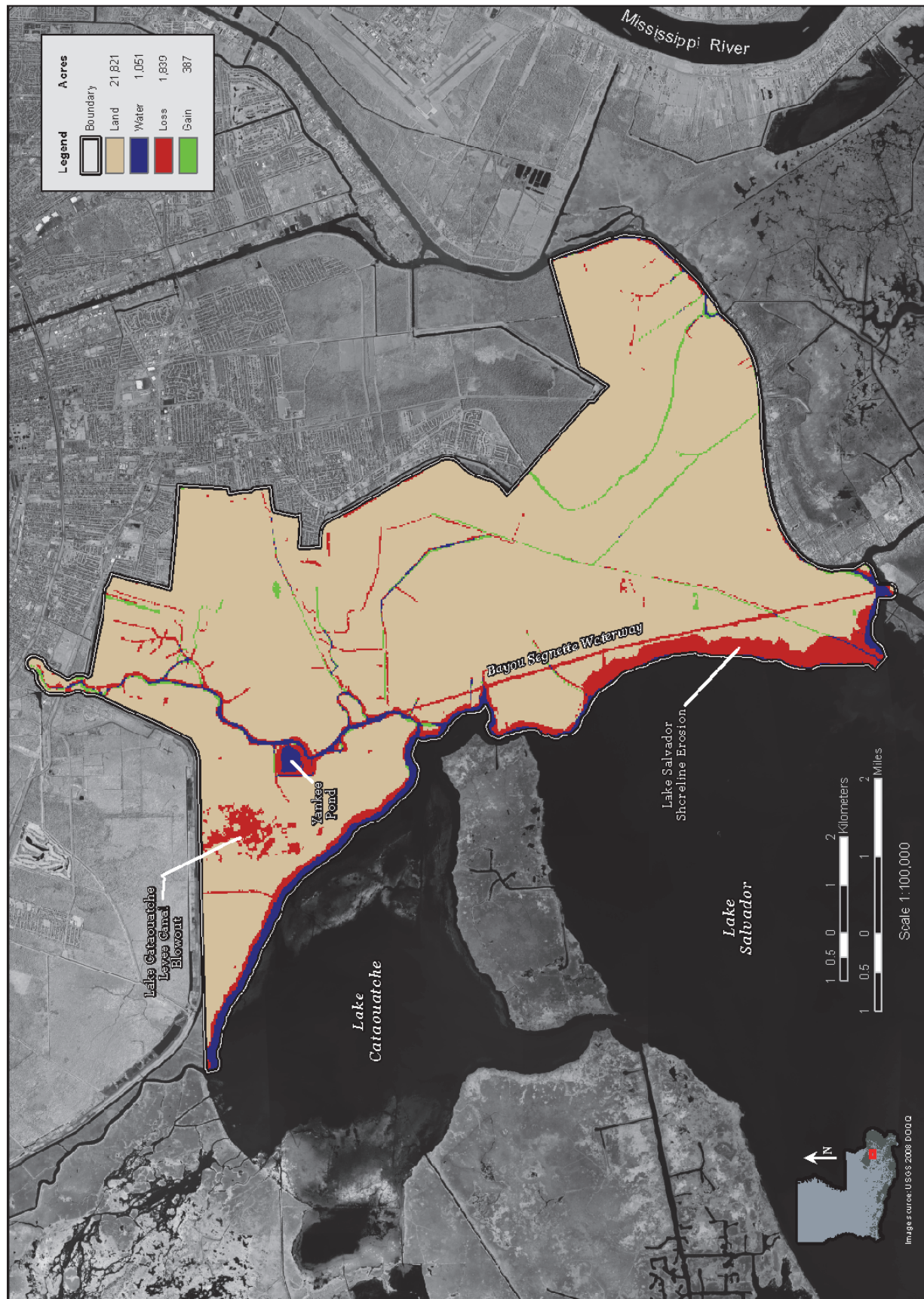


Figure 4. Net land area change for the Bayou Segnette Waterway project area (1956-2008; Barras et al. 2008, and Barras 2009), identifying four areas of interest, Lake Cataouatche Levee Canal blowout area, Yankee Pond, Lake Salvador shoreline including the Lake Salvador Wetlands Creation site, and numerous oil and gas access canals.

non-developed areas along the BSWW corridor consist of comparatively healthy non floating highly organic peat marshes, and floating marshes – also known as “flotant” (Figure 5).¹ Floating marsh is a type of coastal freshwater marsh typified by a buoyant mat of organic and mineral sediment, root mass and vegetation – living, dead, and decomposing – unattached to the soil below such that the mat elevation fluctuates with the water level (Taylor et al. 1989, Sasser 1994, Mitsch and Gosselink 2000, and Carpenter et al. 2007). With limited capacity in conventional and existing placement areas, and with recent interest in and the execution of thin-layer application of dredged material atop floating marsh (Cahoon and Cowan 1988; Carpenter et al, 2007; Ray 2007; Welp and Ray 2011), these floating landscapes provide placement options that have seldom been considered. Additionally, since floating marsh in the Barataria Preserve typically floats atop approximately 1 foot of organic sludge (Sasser et al. 1996)², placing or pumping dredged material beneath these floating landscapes provides another option.

5.1.3 Elevation

Over the last 50 years, vast amounts of Louisiana wetlands have succumbed to relative sea-level change, partially as a consequence of sediment deprivation. With subsidence and accretion processes significantly affecting the health and fate of Louisiana marshes, elevation has become an increasingly important factor. One method of artificially introducing sediment back into these ecosystems, and thereby reducing relative sea level rise and land loss, is through the beneficial use of dredged material. Landscapes that reside below the ideal elevation for fresh and intermediate marsh provide options for dredged material placement and thereby reintroducing sediment into the system.

In 2004, the ideal marsh elevation for landscapes in the fresh and intermediate regions of the Barataria basin was established at +1.4 feet (NAVD-88; Belhadjali 2004). Factoring in the highest rate of subsidence for the zone containing the Barataria Preserve, 0.39 in/yr (the range is 0.08 in - 0.39 in per year for the next 50 years; Coastal Protection and Restoration Authority of Louisiana 2012) and the highest accretion rate observed by Taylor et al. (1989), 0.31 in/yr, it was determined that all attached marsh (in close proximity to the BSWW) with elevations below +1.6 feet (NAVD-88) are viable wetland placement sites over the course of the next two maintenance events (approximately 30 years).

¹ Personal Communication. Christopher Swarzenski. 2012. Baton Rouge, LA, U.S.G.S.

² Personal Communication. Jeffrey Corbino, 2012, Baton Rouge, LA, U.S. Army Corps of Engineers.

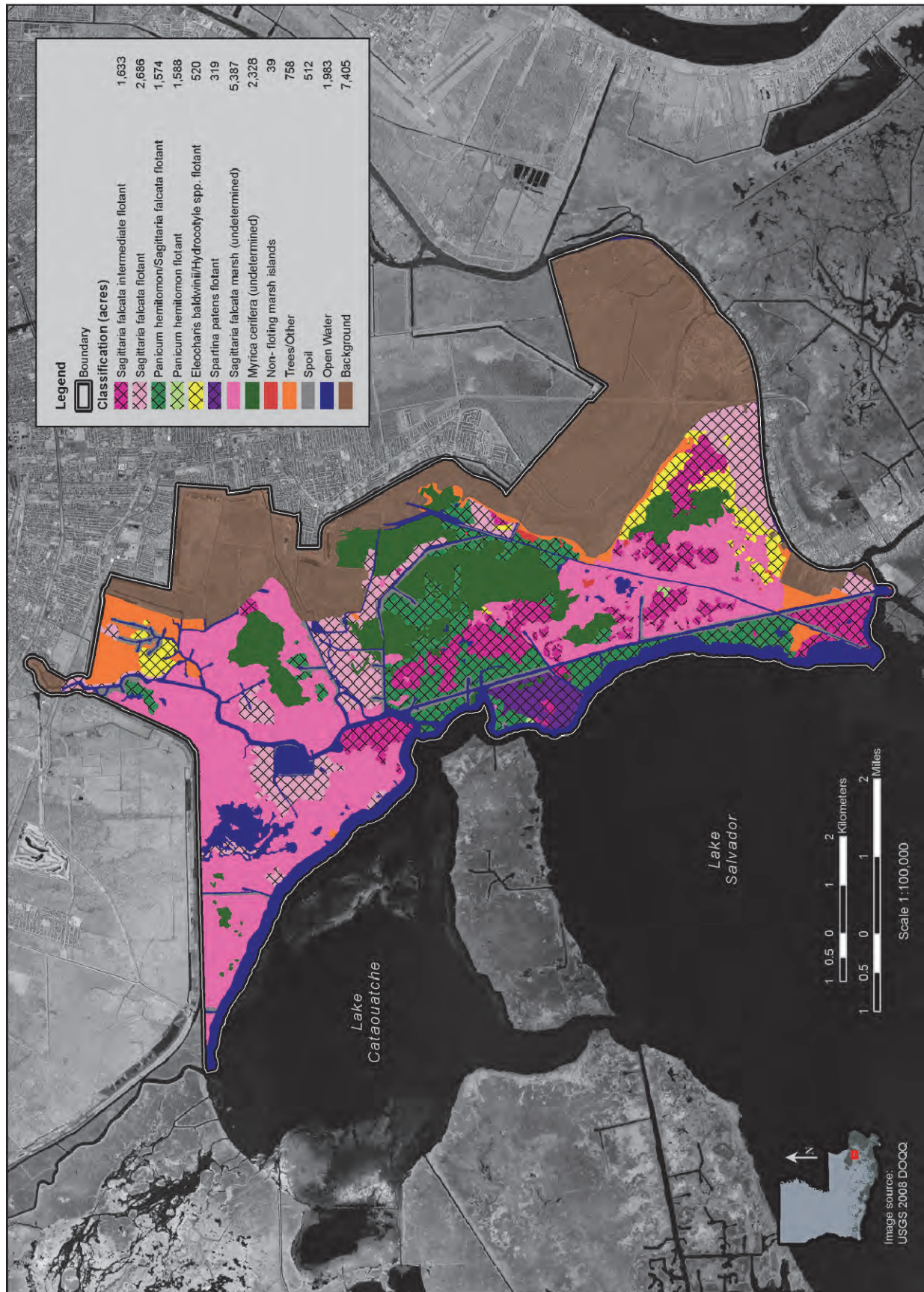


Figure 5. Floating Marsh communities within the BSWW project area (Evers et al. 1996 - modified).

The bare earth returns from the 2008 LiDAR and the 1996 flotant data (best available floating marsh data set) were used to establish marsh substrate elevations and potential attachment of the marsh, respectively. Though the 1996 flotant data contain areas along the BSWW that were classified as "undetermined attachment," the majority of the marshes along BSWW are non floating, highly organic peat marshes.¹ The exceptions are wax myrtle islands, which generally are floating.

The majority of the project area landscape along the BSWW and between waterway miles 6.5 and 12.2 reside at elevations below those ideal for fresh/intermediate marsh (Belhadjali 2004), are sediment deficient (Taylor et al. 1989), and therefore could benefit from the introduction of sediment (Figure 6). Though floating landscapes are sensitive to the quality and quantity of sediment addition, attached marsh (or the areas of undetermined attachment along the northern half of the BSWW), could potentially receive larger volumes of dredged material. South of the North Canal are areas with high rates of shoreline erosion, and/or that contain areas with alternating low to typical elevations (approximately +2.0 feet, NAVD-88). Though the addition of dredged material could increase attached marsh elevation to a range that is more typical in fresh and intermediate marshes, one major concern is that the increase in land elevation and stability could subject those areas to greater likelihood for development (USACE 1989). Given the age of the flotant data and the uncertainty surrounding the locations of attached and floating marsh, it is recommended that new flotant surveys and mapping are performed prior to the selection of placement sites and preparation of a Dredged Material Management Plan (DMMP) for future Bayou Segnette maintenance dredging.

5.2 Placement Areas

5.2.1 Lake Cataouatche Levee Canal Blowout

The landscape analysis revealed a small area of storm and blowout damage approximately 1-mile west of the BSWW (at waterway mile 8.5; Figure 7). Given the fine particle size of the BSWW sediments, the construction of a "geocrib" or rock dike at the site of the blowout would be required to contain the sediments. Generally, the elevation of the new sediments will decrease over time as the sediments desiccate and consolidate. Desiccation and consolidation models such as the SETTLE and PSDDF packages in the

¹ Personal Communication. Jeffrey Corbino, 2012, Baton Rouge, LA, U.S. Army Corps of Engineers.

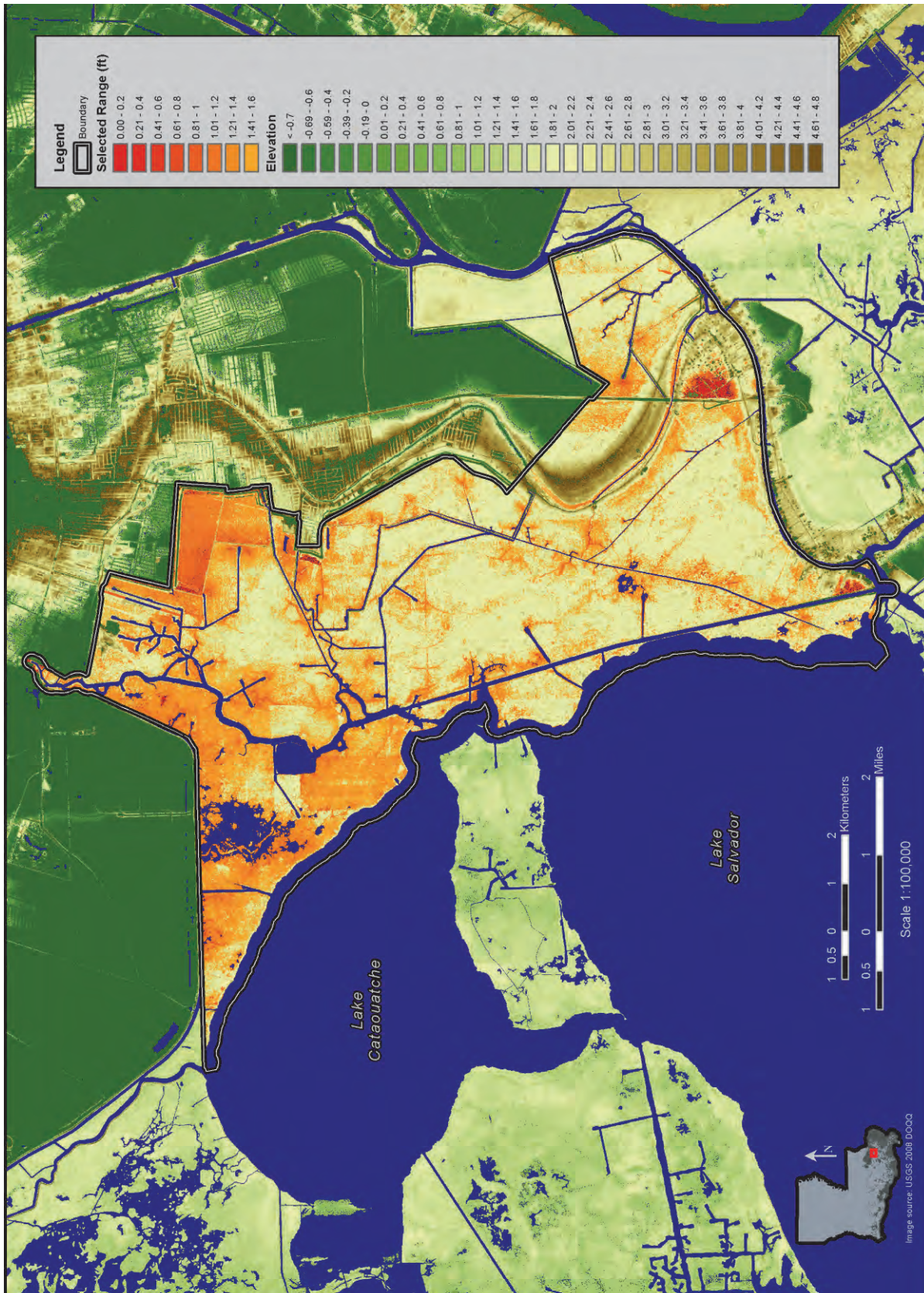


Figure 6. Bayou Segnette Waterway project area elevations (USACE 2008).



Figure 7. Thin-layer placement sites within the Jean Lafitte National Historical Park and Preserve one growing season (2011) after sediment addition (photographs provided by the National Park Service).

ADDAMS software (Schroeder 1997) can determine what the initial elevation of the sediments should be so the elevation of the sediments after desiccation and consolidation is similar to the elevation of nearby marshes. Current bathymetry is unavailable in the area; therefore, the depths of water and total capacity within the blowout site are unknown. However, using a conservative approach, an assumed standing water depth near zero (where the elevation of the blow-out area water surface and substrate are nearly identical), and adding dredged material to the height of nearby marsh (average water level is 6 in (15.2 cm) below marsh elevations), there is approximately 244,000 CY of capacity (post-dewater and desiccation) within the Lake Cataouatche Levee Canal blowout area (extent of blowout area based on habitat data; USGS 2007). This estimated capacity was computed for open water sections of the blowout area only, and does not include any assumption about the amount of material that can be placed with overflow into surrounding wetland vegetation.

5.2.2 Yankee Pond

Yankee Pond was historically an agricultural field that was abandoned and that subsequently subsided. Presently, it is a shallow open water body (depths range from 1.8 to 2.5 feet) with a few remnant forested islands. The Yankee Pond site is bounded by wetlands to the north and west, and intermittent "spoil" banks to the south and east separating the pond from the BSWW. Yankee Pond is currently being considered under other mitigation and restoration projects [Coastal Impact Assistance Program, Hurricane & Storm Damage Risk Reduction System, and the Polder reconnaissance study (DHV Group 2009)], and since the sediment required for wetland restoration is scarce and/or costly to transport, coordinating

with other Agency/Project managers could maximize resources, provide additional management alternatives, and decrease costs.

Currently, the Hurricane & Storm Damage Risk Reduction System (HSDRRS) mitigation project is considering two restoration options within Yankee Pond. The first is a 14.5 acre site at the northwest corner of the pond. The second consists of the remaining 102.7 acres within the pond. Since the pond is open to an oil and gas access canal to the west, and the BSWW to the east and south, temporary earthen retention dikes (built higher than the "target" grade of the restored marsh) would be required along the perimeter of the pond. The HSDRRS mitigation project is proposing to dredge material from the BSWW (100,000 CY for the 14.5 acre site, and 650,000 CY for the 102.7 acre site) and pump that material into the restoration sites via pipeline. Though the HSDRRS project may use Bayou Segnette as a borrow source for Yankee Pond, this dredging and material placement would be independent of any routine maintenance of the waterway. However, since the placement and retention of dredged material in Yankee Pond is cost prohibitive, future O&M efforts could take advantage of other dredging, mitigation, or restoration efforts – specifically, NEPA clearance and containment structures.

5.2.3 Lake Salvador Wetlands Creation Site

The Lake Salvador Wetlands Creation Site (Disposal Area #4, previously referred to as BSDA-01-1; Appendix Figure B3) is bounded on its western side by a rock revetment, which is rooted into the lake rim at each end by rock dikes. The eastern side of the restoration area is bounded by an existing rock dike, which separates it from the BSWW. Wetlands, which bound the site at its northern and southern sides, were used in previous restoration efforts to separate the sediment before returning the effluent to the lake's receiving waters. In 2007, 100,000 CY of BSWW dredged material was placed within the Lake Salvador Wetlands Creation Site. In 2010, the West Closure Complex project delivered approximately 500,000 CY of additional sediment to the wetlands creation site. High resolution oblique aerial photography acquired in 2011 shows the project area fully pumped in with sub-aerial sediment. Field observations show that the project area was still full in February 2012.¹ Though the wetlands creation site does not contain near-term placement capacity, long-term observations are recommended for assessing future availability.

¹ Personal Communication. Jeffrey Corbino, 2012, Baton Rouge, LA, U.S. Army Corps of Engineers.

5.2.4 Oil and Gas Access Canals

It has been estimated that more than 590 acres of land within the JLNHPP were directly affected by non-historic canals, "spoil" banks, and dikes (NPS 2009). The NPS has identified more than 20 linear miles of non-historic canals that, through reclamation activities, could restore hydrology-related functions, resources, and values within the JLNHPP (NPS 2009). Previous canal reclamation within the JLNHPP (and along the BSWW) used multiple methods of backfilling. One canal was reclaimed by returning the "spoil" material and then using dedicated dredging from Lake Salvador to supply additional sediment. This was accomplished without using a containment structure, but rather allowing sediment to leak from the plugged canal and into the surrounding marsh (Baustian et al. 2009). The average dimensions of those canals (pre-backfilling) were approximately 50 yards wide, 1 yard deep, and 1,000 yards in length; for an approximate capacity of 50,000 CY for every 1,000 linear yards of canal. There are three canals (five reaches requiring plugging) that intersect the BSWW and are permitted for reclamation. These canals are (1) North Canal West (850 yards in length), (2) North Canal East (1,000 yards), (3) unnamed canal south of North Canal West (300 yards), (4) Pipeline Canal West (1,200 yards); and (5) Pipeline Canal East (4,400 yards). Though these canals provide alternate placement options, the costs of containment and transport would be an important consideration where financial efficacy is a factor in choosing among placement methods.

5.2.5 Thin-Layer Placement on Floating Marsh

Given the abundance of floating vegetation along the BSWW corridor, and the inability to use conventional placement methods on these landscapes, the thin-layer application of dredged material provides potential solutions to the capacity and sediment input restrictions within the BSWW project area. Studies examining mineral sediment additions to fresh floating marsh are rare; only one such study is available in the literature (Carpenter 2005; Carpenter et al. 2007). At the application rates used in the study (0, 2, 7, and 17 kg of sediment per m²), no increase in vegetative biomass was observed and the addition of sediments increased bulk density of the floating marsh mat (Carpenter et al. 2007). After one growing season, it appeared that between 28 and 59% of the sediment stayed in the 0 – 10 cm range, between 52 and 82% migrated down to the 25 cm range, and the rest fell through the mat (Carpenter 2005). However, where the aforementioned study used semi-dry sediment additions; thin-layer placement typically

applies thin layers of sediment slurry with a concentration of approximately 8 to 10 g per L.¹

Thin-layer placement has been used on floating marsh previously (primarily on saline marshes; Shafer 2002; Ray 2007). Anecdotal reports indicate the material rapidly sinks into the floating marsh instead of accumulating on the surface (Shafer 2002; Cahoon and Cowan 1987). In 1992, LaSalle returned to Cahoon and Cowan's Dog Lake and Lake Coquille sites to assess biotic and physical changes. LaSalle found that the marshes at both dredged material placement sites contained healthy stands of vegetation. Species distributions and abundances in the Lake Coquille placement area were similar to nearby reference areas. However, vegetative differences were observed between the Dog Lake placement and reference areas. The thin-layer placement area consisted predominantly of *S. alterniflora* and *Salicornia* spp., whereas *D. spicata*, *Juncus roernerianus* (needle rush), and *S. alterniflora* dominated reference sites. Further, shoot density was approximately 20 percent lower within the Dog Lake placement area.

Limited areas of thin-layer placement of organic material occurred in 2010 within the JLNHPP in conjunction with canoe trail maintenance² (National Park Service 2008). Photographs of thin-layer application areas are shown in Figure 7. The areas of thin-layer placement appeared to be thriving at the beginning of the 2011 growing season (potentially due to the addition of nutrients from the dredged material); the existing *Typha* spp. vegetation was rotted and/or lodged, allowing for the robust re-growth of *Sagittaria* spp. in the following growing season. However, a replacement stand of *Typha* spp. is anticipated for subsequent seasons.² Quantitative monitoring of the JLNHPP thin-placement sites has not been conducted so the physical properties of the floating marsh mat pre- and post-placement are unknown.

The capacity of the thin-layer placement application is dependent on the location of the discharge pipe and the placement depth of the material. Thin-layer placement can spread material approximately 100 to 300 ft (30 to 100 m) from the discharge location depending on the material characteristics and equipment used (Shafer 2002). If the discharge location is directly from the dredge, a large proportion of the material will be applied to the shallows of the BSWW and the adjacent "spoil" banks. If a discharge

¹ Personal Communication. Paul Schroeder. 2011. Vicksburg, MS. U.S. Army Corps of Engineers.

² Personal Communication. Haigler Pate. 2008. New Orleans, LA. National Park Service.

pipe is located atop the existing "spoil" banks, the majority of the dredged material can be placed on the marsh.

The placement depth of the dredged material is a critical factor in determining the placement capacity of this option and maintaining and/or improving the condition of the floating marsh. The placement depth may be limited by one of two factors: maintaining the buoyancy of the marsh and the tolerance of the marsh vegetation. It can be presumed that the addition of higher mineral content sediments from the BSWW would increase the floating marsh mat bulk density and decrease buoyancy. Previous thin-layer placement projects in salt marsh found vegetation was able to resprout if placement depths did not exceed 5.9 in (15 cm). However, freshwater marsh appears to be more sensitive to sediment depth (Ray 2007). Based on this sensitivity, the authors recommend a placement depth of no more than 1.57 in (4 cm) after dewatering and initial compression.

Assuming an initial compression factor of 4 (initial depth 1.5 and 4 times the final depth, respectively) after initial dewatering and consolidation, the approximate placement capacity of the floating marsh was calculated for different spray distances from the top of the "spoil" bank and different target depths (Table 4; Appendix Figures B1-B12). An array of 50-ft buffers was used to a distance of 300-ft, since placement is typically limited to an area less than 300-ft (100 m) from the spray equipment (Ray 2007). Appendix B figures provide the capacity of one 50-ft buffer for each reach with a compression factor of 4. This approach, which assumes that those areas which were identified as floating in the 1996 flotant survey remain floating, provides a per reach assessment for rapid determination of placement area and height needs. For all available land within the 300 foot buffer (excluding areas under and near structures), applying 15 cm of dredged material (pre-dewater and desiccation) would result in approximately 540,000 CY of capacity. After dewater and initial compression, this material would assume a depth of 4 cm, and account for approximately 143,000 CY of material.

There are a number of assumptions intrinsic in the analysis presented in Table 4 and the values presented should not be considered absolute. The authors recommend further settling tests be conducted on the BSWW sediments and modeling of the settling and flow behavior of the dredged material using a software package such as the Automated Dredging and Disposal Alternatives Modeling System (ADDAMS) (Schroeder 1997) to determine the actual placement capacity of this option.

Table 4. Estimated placement capacities of thin-layer placement option at different spray distances and target sediment depths.

Distance from top of spoil bank (ft)	Dewatered sediment capacity (CY) at target depths of			Proportion of total dredged material (MVN volumes) at target depths of			Proportion of total dredged material (ERDC volumes) at target depths of		
	0.79 in	1.18 in	1.57 in	0.79 in	1.18 in	1.57 in	0.79 in	1.18 in	1.57 in
50	12261	18391	24521	0.10	0.15	0.20	0.07	0.11	0.14
100	24375	36562	48750	0.20	0.29	0.39	0.14	0.21	0.28
150	36353	54530	72706	0.29	0.44	0.58	0.21	0.31	0.42
200	48229	72344	96459	0.39	0.58	0.77	0.28	0.42	0.55
250	60009	90013	120018	0.48	0.72	0.96	0.34	0.52	0.69
300	71681	107521	143362	0.58	0.86	All	0.41	0.62	0.82

Note: Depths based on the follow equivalency: 0.79 in (2 cm), 1.18 in (3 cm), and 1.57 in (4 cm) assuming a consolidation/desiccation ratio of 4.0 leading to a final bulk density of ~ 1 g/cc.

5.2.6 Dredged Material Placement beneath Floating Marsh

Another placement option related to floating landscapes is the introduction of sediment-laden water beneath the floating marsh mat (Taylor et al. 1989). The floating marsh in the Barataria Preserve typically floats atop approximately 1 foot of organic sludge.¹ Dredged material can be pumped beneath the floating marsh mat, leaving the mat substrate unaltered. The dredged material would decrease the depth of free water and/or fluid ooze in the floating marsh vertical profile, altering the profile to one more similar to a quaking marsh (Type VI marsh; Sasser et al. 1995). Since the quaking marsh is not freely floating, it is subject to overland flow that carries mineral sediments. In present condition, the floating marsh is never subject to overland flow conditions aside from extreme events.

It is unclear how the dredged material would behave if pumped beneath the floating marsh substrate. The flow behavior will determine how much dredged material can be pumped beneath the floating marsh. The authors recommend further settling tests be conducted on the BSWW sediments and modeling of the settling and flow behavior of the dredged material using ADDAMS (Schroeder, 1997) to determine the placement capacity of this option. This option could be performed as a stand-alone USACE project, and/or proposed as a Coastal Wetlands Planning, Protection, and

¹ Personal Communication. Christopher Swarzenski. 2012. Baton Rouge, LA.

Restoration Act demonstration project. Additional exploration of dredging technology and techniques will be required to maximize the capacity and benefit of this option. Trials will be required to test flow rates and solids concentrations that are acceptable for maximizing the capacity and benefit beneath the mats, while minimizing adverse impacts to the floating marsh. It is recommended that this proposed application of dredged material be confined to areas of need (i.e., to thinning mats), since a quaking marsh endpoint would be preferable to one of open water.

5.2.7 Dredged Material Placement on Wetland Sites

As discussed previously, areas of attached and forested wetlands provide conventional placement opportunities. The forested wetlands and wetlands of undetermined attachment along the northern and southern-most reaches of the BSWW provide potential areas for conventional placement and/or thick-layer spray of dredged material (Appendix B Figures). Given the age of the floating marsh data (1996), and the undetermined nature of these landscapes, it is recommended that an assessment of attachment (buoyancy) be performed before thick-layer application is performed.

5.2.8 Open Water Dredged Material Placement Sites

Another option is to place material dredged from the BSWW into open water dredged material placement sites. Material dredged from the BSWW could be placed in hopper barges or bottom-dump scows and transported to nearby lakes (Cataouatche and Salvador) or the Gulf of Mexico for placement. These open water sites are typically cost prohibitive and the least environmentally acceptable of traditional placement options since they remove sediment from the eroding and subsiding coastal environment; thus they are not compatible with national and state priorities for using dredged material for coastal restoration projects in Louisiana.

6 Placement Alternatives

Approximately 500,000 CY of dredged material is to be removed from the BSWW navigation channel. Traditionally, maintenance dredging of the BSWW has used "spoil" banks and confined disposal units for the placement of dredged material. However, estimates show that those traditional sites are at or near capacity (USACE - New Orleans District), or those traditional sites have been opposed by the NPS due to the deleterious effects on the ecological function of the nearby Jean Lafitte National Historical Park and Preserve (JLNHPP). Placement sites must be in the immediate vicinity of the dredging to maintain a feasible project. Additional pumping or barging of material to distant locations is not practical in terms of cost. The BSWW sediments are very fine and do not readily stack, so transport to an open water placement site or other remote site is impractical. Alternative placement options are described below. Given the length of time since the entire BSWW was dredged (1971), the volume of dredged material is relatively large in comparison with previous maintenance dredging operations. The final material management plan will likely necessitate a suite of placement options.

Table 5 provides a reach-by-reach summary of the available placement capacity by placement site type. The capacities enumerated in Table 5 should be considered preliminary. Fine and organic sediments do not behave in the same manner as sandy sediments, so further study is necessary to determine the dewatering, consolidation, and desiccation behavior of the sediments. Additional small-scale pilot studies should also be implemented to determine the response of floating marsh to thin-layer application of dredged material. It should be noted that no capacity was estimated for the under floating marsh option; additional study is required to determine the feasibility and capacity of such an option. In addition to each option listed, the no action alternative should also be considered.

The no-action alternative should be considered for each reach individually. While the BSWW has accreted an average depth of 3 ft of sediment since the last maintenance dredging (Mathies and Russo 2003), the sediment depths are not distributed proportionally along the length of the waterway. If no dredging were to take place, increased sediment accretion would eventually cause the waterway to become unnavigable. In areas of significant shoaling,

Table 5. Reach by reach summary of dredged material placement capacity.

Reach	In-situ volume (CY)	Estimated fill volume ¹ (CY)	Thin-layer placement capacity (100-ft buffer) ² (CY) ³	Thin-layer placement capacity (100-ft buffer) ² (CY) ⁴	Dredged material wetland capacity (CY) ³	Dredged material wetland capacity (CY) ⁴	Additional placement sites capacity (CY)	
1	27,600	55,200	7,600	18,300				
2	18,600	37,200	7,600	18,300	53,000	142,100	330,000	Pipeline Canal West/East
3	20,800	41,600	5,600	13,400				
4	27,200	54,400	7,600	18,300	60,300	161,700	15,000	Unnamed Canal
5	27,000	54,000	7,900	19,000			92,500	North Canal West/East
6	41,300	82,600	2,300	5,500				
7	60,500	121,000	5,300	12,700	23,600	63,300		
8	75,600	151,200	5,900	14,100	129,300	346,900	750,000	Yankee Pond
9	75,100	150,200	7,400	17,700	137,600	368,800	244,000	Lake Cataouatche
10	60,100	120,200	7,800	18,800	252,600	677,100		
11	58,200	116,400	8,100	19,400	17,600	47,100		
12	40,300	80,600	4,300	10,300	48,300	129,500		

¹Assuming bulking ratio of 2.

²Assuming 200-ft from centerline to back-slope of spoil, 100-ft buffer available for thin-layer placement.

³Assuming compression/desiccation ratio of 1.5 (final bulk density ~0.5 g/cc).

⁴Assuming compression/desiccation ratio of 4 (final bulk density ~1.0 g/cc).

sediments would be subject to frequent re-suspension from passing watercraft. Priority reaches should be identified prior to the preparation of future dredged material management plans.

Discontinuance of O&M work on Bayou Segnette and Barataria Bay Waterways would result in navigation restrictions on offshore supply boats, drilling rigs, commercial fishing vessels, and small craft, which would result in regional economic losses due to lack of access for harvest of marine resources and extraction of oil and gas resources (USACE 1976).

Figure 8 shows the reach-by-reach total placement capacity excluding any capacity from the under floating marsh placement option, assuming compression/desiccation ratios of 1.5 and 4.0, respectively. Reaches 2, 4, 5,

8, 9, and 10 all have adequate placement capacity regardless of the assumed compression/desiccation ratio. If a larger compression/desiccation ratio is assumed, reaches 1, 7, and 12 also have adequate placement capacity. Excess material in reaches 1 and 3 can be placed in adjacent reach 2 at the Pipeline Canal site. Excess material in reaches 6 and 7 can be placed in reach 8 at the Yankee Pond site. Excess material in reaches 11 and 12 can be placed in reaches 8, 9, or 10 at the dredged material wetland sites, the Lake Cataouatche, or Yankee Pond sites (in order of increasing distance from reaches 11 and 12).

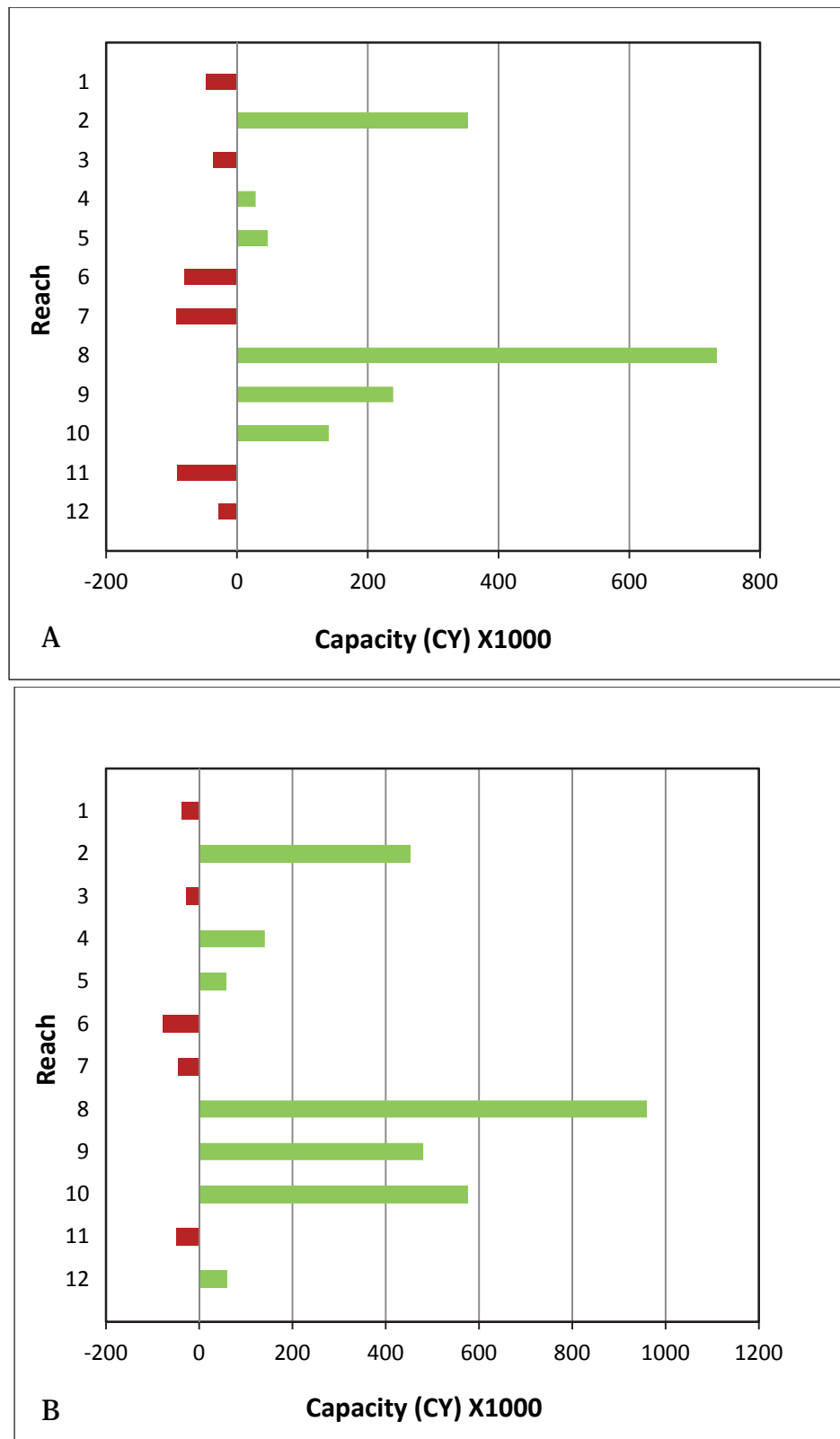


Figure 8. Reach-by-reach total placement capacity assuming a compression/desiccation ratio of A. 1.5 and B. 4.

7 Conclusions

The primary purpose of this report was to identify technically viable options for the placement of BSWW dredged materials. The 12.2-mile BSWW was last partially dredged in 2007 and was last completely dredged in 1971. Approximately 3 ft of material has accumulated within the -8-ft MLG BSWW navigation channel since prior dredging operations. Analysis of the BSWW sediments indicates the material is fine-grained, free of major contaminants of concern, and suitable for environmental enhancement, agricultural, and land creation uses. The majority of the land adjacent to the BSWW lies within the JLNHPP boundary so a material management plan should be developed in collaboration with the JLNHPP managers.

Landscape analysis was used to identify areas of land subsidence and loss near the BSWW that would benefit from sediment additions. Areas identified include the following: Lake Cataouatche Levee Canal blowout area, Yankee Pond, Lake Salvador shoreline (including the Lake Salvador Wetlands Creation site) oil and gas access canals, thin floating marsh adjacent to the BSWW, and small patches of attached or undetermined marsh types that are below ideal marsh elevation. The Lake Salvador site was rejected for use during this dredging operation as additional material was recently added to the site and is currently at or near capacity. However, additional capacity may develop over time as the material consolidates and desiccates. While dredged material placement at the Lake Cataouatche Levee Canal blowout area, Yankee Pond, and the oil and gas canals each have their own unique technical challenges such as retention dike construction, material transport, etc., the most significant knowledge gaps and technical challenges exist for the wetland placement alternatives. Wetland creation and replenishment using dredged material requires the accurate determination of the land surface elevation after dewatering, consolidation, and desiccation of the dredged material placement.

To the authors' knowledge, no previous studies have been conducted to assess the placement of dredged material beneath floating marsh mats, and most knowledge of the effects and behavior of thin-layer placement on floating marsh mats were obtained through anecdotal accounts. Two factors determine the ultimate success of thin-layer placement on floating marsh: the ability of the floating mat to remain buoyant during and after

application and the ability of the vegetation to recover after the stress of the sediment input. Assuming the floating mats in the JLNHPP adjacent to the BSWW are approximately 0.4-m thick, the resilience of the vegetation is the main concern. Most thin-layer placement in wetlands has occurred in salt marsh environments; salt marsh vegetation is less sensitive to sediment inputs than freshwater vegetation. Negative impacts to freshwater vegetation can occur with sediment inputs of less than 1 cm, although adult plants can handle additions of up to 4 cm after initial consolidation and desiccation (Ray 2007). Limited regions of *Spartina patens* in reaches 6 and 7 can handle greater depths of dredged material than the surrounding freshwater vegetation such as *Sagittaria* spp.

As a whole, the BSWW has adequate placement capacity for the volume of material to be dredged, assuming thin-layer placement on floating marsh is a viable placement alternative and estimated capacities at the other placement sites are reasonable. The BSWW was divided into 12 mile-long reaches, the placement alternatives for each reach were determined, and the placement capacity for each alternative was estimated. At least 6 of the 12 reaches do not have adequate placement capacity within reach. The excess material in reaches 1, 3, 7 and 11 can be accommodated in adjacent reaches. However, no reaches adjacent to reaches 6 and 12 of the BSWW have adequate placement capacity for additional dredged material. Yankee Pond and the oil and gas canals provide much of the placement capacity for the BSWW. Due to the fine-grained nature of the BSWW sediments, transport offers its own technical issues as fine-grained, organic materials do not stack or dewater as readily as sandy material.

The applications presented herein that use dredged material in floating environments are relatively novel and further study should be undertaken to determine their viability. Areas targeted for dredged material placement on wetland sites should be assessed to determine attachment and to confirm elevation needs. Thin-layer application of dredged material on floating marsh and pumping dredged material beneath floating marsh were both proposed as part of a report on ecological characterization and management recommendations within the JLNHPP (Taylor et al. 1989). The authors recommend an integrated pilot study combining thin-layer placement on floating marsh and pumping dredged material below floating marsh mats. The total extent of such a pilot study would depend on resource and site availability. Previous small scale sediment studies on floating marsh were conducted on experimental plots as small as 1 m².

However, larger experimental plots would be more consistent with thin-layer placement techniques. This pilot study should be accompanied by pre- and post-placement monitoring of biomass condition and substrate properties. Post-placement monitoring should continue for a minimum of five years to determine the long-term effects of the treatments on the marsh. The marsh condition should be assessed by an ecologist or plant biologist familiar with the floating marsh and quaking marsh communities.

Ultimately, future material management plans must be made after considering multiple factors: technical constraints, costs, environmental impacts and/or benefits, stakeholder input, etc. All sites, especially those that utilize novel techniques, should be monitored. Additionally, evaluation of the prescribed monitoring results would be valuable for development of technical guidance on implementation in similar cases elsewhere. The potential benefit from monitoring data is the identification of new dredged material placement capacities and techniques where options have been technically constrained or cost prohibitive within traditionally accepted methods.

References

- Barras, J.A., J.C. Bernier, and R.A. Morton. 2008. Land area change in coastal Louisiana—A multidecadal perspective (from 1956 to 2006): U.S. Geological Survey Scientific Investigations Map 3019, scale 1:250,000, 14 p. pamphlet.
- Barras, J.A. 2009. Land area change and overview of major hurricane impacts in coastal Louisiana, 2004-08: U.S. Geological Survey Scientific Investigations Map 3080, scale 1:250,000, 6 p. pamphlet.
- Baustian, J.J., R.E. Turner, N.F. Walters, and D.P. Muth. 2009. Restoration of dredged canals in wetlands: a comparison of methods. *Wetlands Ecology and Management* 17:445–453.
- Belhadjali, K. 2004. Dedicated Dredging on the Barataria Basin Landbridge - CWPPRA Priority Project List 11. Louisiana Department of Natural Resources, Coastal Restoration Division, Baton Rouge, Louisiana.
- Brandon, D. L., and R. A. Price. 2007. Summary of available guidance and best practices for determining suitability of dredged material for beneficial uses. ERDC/EL TR-07-27. Vicksburg, MS: U.S. Army Engineer Research and Development Center.
- Cahoon, D. R., and J. H. Cowan Jr. 1987. Spray disposal of dredged material in coastal Louisiana: habitat impacts and regulatory policy limitations. Louisiana Sea Grant College Program. Baton Rouge, LA: Center for Wetland Resources, Louisiana State University.
- Cahoon, D. R., and J. H. Cowan Jr. 1988. Environmental impacts and regulatory policy implications of spray disposal of dredged material in Louisiana wetlands. *Coastal Management* 16:341– 362.
- Carpenter, K. 2005. Effects of adding sediment to a fresh water thin mat floating marsh. Baton Rouge, LA: Oceanography and Coastal Sciences, Louisiana State University.
- Carpenter, K., C. E. Sasser, J. M. Visser, and R. D. DeLaune. 2007. Sediment input into a floating freshwater marsh: Effects on soil properties, buoyancy, and plant biomass. *Wetlands* 27(4):1016-1024.
- Coastal Protection and Restoration Authority of Louisiana. 2012. Louisiana's Comprehensive Master Plan for a Sustainable Coast. Baton Rouge, LA: Coastal Protection and Restoration Authority of Louisiana.
- DHV Group. 2009. Subsidence reversal through Marshland restoration A pilot project in Louisiana. DHV Group, BC Amersfoort, Netherlands.
- Evers, D. E., G. O. Holm, and C. E. Sasser. 1996. Digitization of the floating marsh maps in the Barataria and Terrebonne Basins, Louisiana. BTNEP Publ. No. 28, Barataria-Terrebonne National Estuarine Program, Thibodaux, LA, USA.

- Holm, G. O. Jr., C. E. Sasser, G. W. Peterson, and E. M. Swenson. 2000. Vertical Movement and Substrate Characteristics of Oligohaline Marshes near a High-Sediment, Riverine System. *Journal of Coastal Research* 16(1):164-171.
- LaSalle, M.W. 1992. Effects of Thin-Layer Disposal of Dredged Material in Louisiana Coastal Marshes. Biloxi, MS: Mississippi State University Coastal Research and Extension Center.
- Mathies, and Russo. 2003. Wetlands Treatment to Address Ammonia Toxicity in the Dredging Process, Bayou Segnette Waterway, Louisiana. Western Dredging Association – Thirty-Third Texas A & M Dredging Seminar.
- Mitsch, W. J., and J. G. Gosselink. 2000. Wetlands. 3d ed. New York: John Wiley and Sons.
- National Park Service. 2008. Debris Removal and Dredging of Canoe Trails within the Barataria Preserve, Jean Lafitte National Historical Park and Preserve: Environmental Assessment.
- National Park Service. 2009. Canal Reclamation at Barataria Preserve, Jean Lafitte National Historical Park and Preserve: Environmental Assessment.
- Natural Resources Conservation Service, United States Department of Agriculture. 2009. Soil Survey Geographic (SSURGO) Database for [Jefferson Parish, Louisiana]. Available online at <http://soildatamart.nrcs.usda.gov>. (Accessed 29 February 2012).
- PBS&J. 2002. Bayou Segnette Contaminant Assessment. Prepared for the U.S. Army Corps of Engineers, New Orleans District. PBS&J, Austin, Texas.
- Ray, G. L. 2007. Thin layer placement of dredged material on coastal wetlands: A review of the technical and scientific literature. ERDC/EL Technical Notes Collection ERDC TN-07-1. Vicksburg, MS: U.S. Army Engineer Research and Development Center.
- Sasser, C.E. 1994. Vegetation Dynamics in Relation to Nutrients in Floating Marshes in Louisiana, USA. Baton Rouge, LA: Coastal Ecology Institute, Center for Coastal, Energy, and Environmental Resources, Louisiana State University.
- Sasser, C. E., J. G. Gosselink, E. M. Swenson, and D. E. Evers. 1995. Hydrologic, vegetation, and substrate characteristics of floating marshes in sediment-rich wetlands of the Mississippi river delta plain, Louisiana, USA. *Wetlands Ecology* 3 (3):171-187.
- Sasser, C.E., J.G. Gosselink, E.M. Swenson, C.M. Swarzenski, and N.C. Leibowitz. 1996. Vegetation, substrate, and hydrology in floating marshes in the Mississippi river delta plain wetlands, USA. *Vegetation* 122:129-142.
- Schroeder, P. 1997. Automated Dredging and Disposal Alternatives Modeling System (ADDAMS).
- Shafer, D. 2002. Thin-layer placement. In *Approaches to Coastal Wetland Restoration: Northern Gulf of Mexico*, ed. R. E. Turner and B. Streever. The Hague, The Netherlands: SPB Academic Publishing.

- Taylor, N., J. W. Day, Jr., and G. Neusaenger. 1989. Ecological characterization of Jean Lafitte National Historical Park: Basis for a management plan. In *Marsh Management in Coastal Louisiana: Effects and Issues*, ed. W. Duffy and D. Clark. 247-277. Washington, DC: U.S. Fish and Wildlife Service, Biological Rep. 89(22).
- USACE. 1956. Bayou Segnette Waterway, La., General Design - Design memorandum no. 1. U.S. Army Engineer District, New Orleans, LA.
- USACE. 1976. Final Environmental Statement – Bayou Segnette Waterway and Barataria Bay Waterway, Louisiana. U.S. Army Engineer District New Orleans, New Orleans, LA.
- USACE. 1989. Environmental Assessment - Bayou Segnette Waterway, Louisiana, Maintenance Dredging. New Orleans, LA: U.S. Army Corps of Engineers New Orleans District.
- USACE. 2008. Louisiana Federal Emergency Management Agency (FEMA) Project - Phase 1 of Louisiana LIDAR Data Development: Lower Mississippi-Lafourche Parish, Louisiana. U.S. Army Corps of Engineers, Saint Louis District contract number DACW43-00D-0511 0014, Task Order 05.
- USGS. 2007. Jean Lafitte NHP 2005 Habitat Data. Lafayette, Louisiana: United States Geological Survey, National Wetlands Research Center.
- Welp, T, L., and G. L. Ray. 2011. Application of Long Distance Conveyance (LDC) of Dredged Sediments to Louisiana Coastal Restoration. ERDC TR-11-2. Vicksburg, MS: U.S. Army Engineer Research and Development Center.

Appendix A: Bayou Segnette Hydrographic Survey Data



Figure A1. Bayou Segnette Waterway hydrographic survey sheet 1.



Figure A2. Bayou Segnette Waterway hydrographic survey sheet 2.

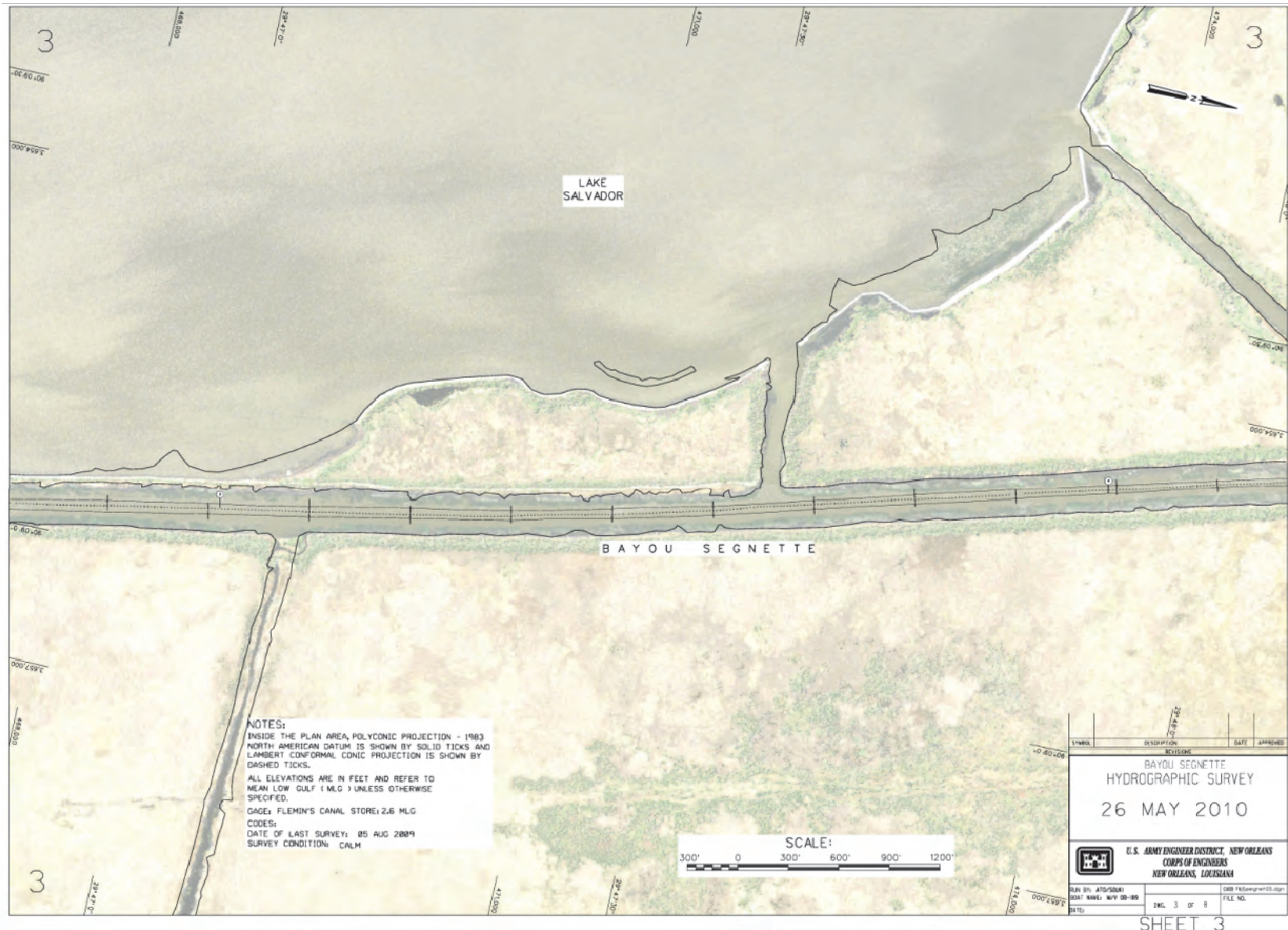


Figure A3. Bayou Segnette Waterway hydrographic survey sheet 3.

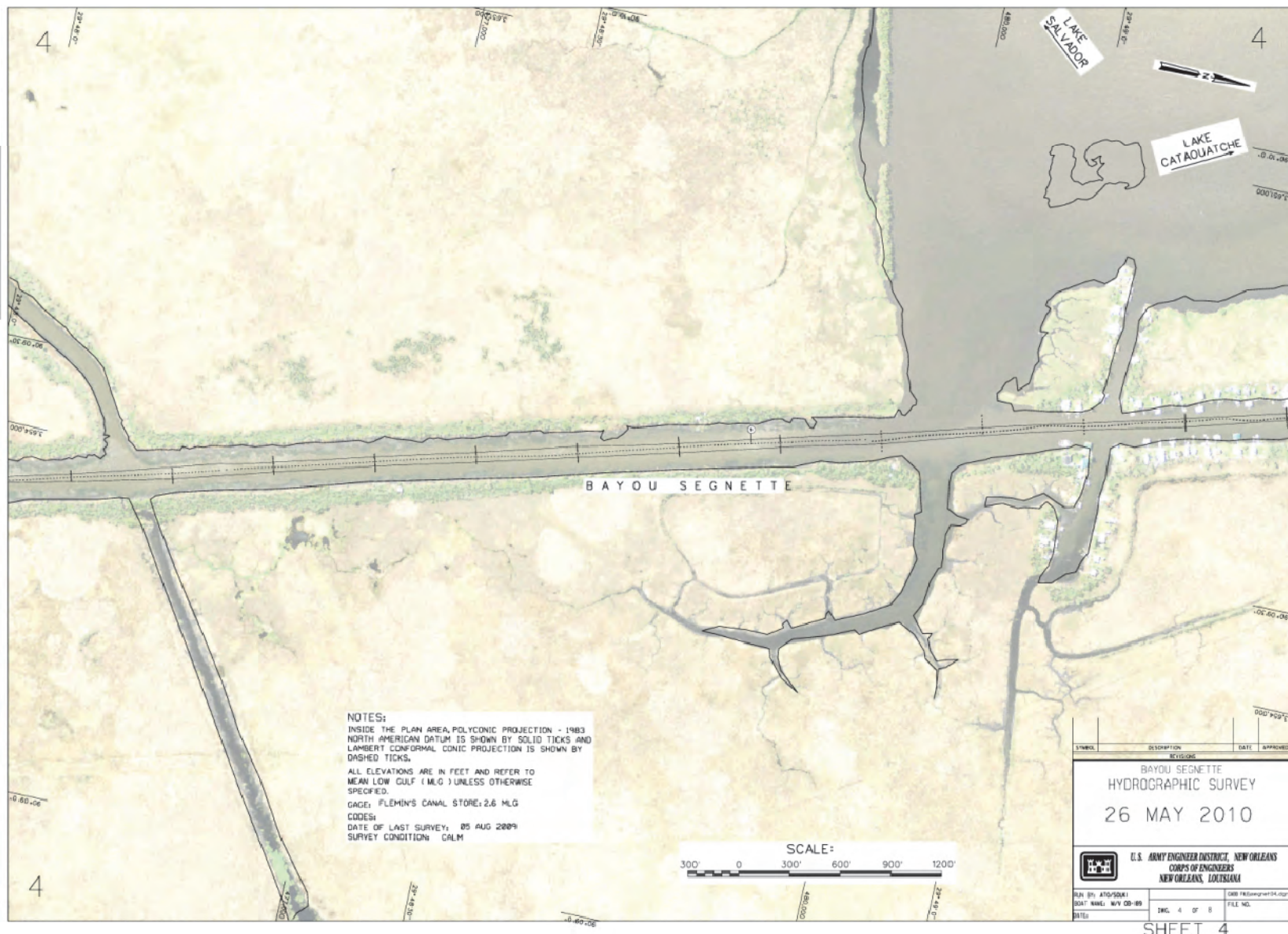


Figure A4. Bayou Segnette Waterway hydrographic survey sheet 4.

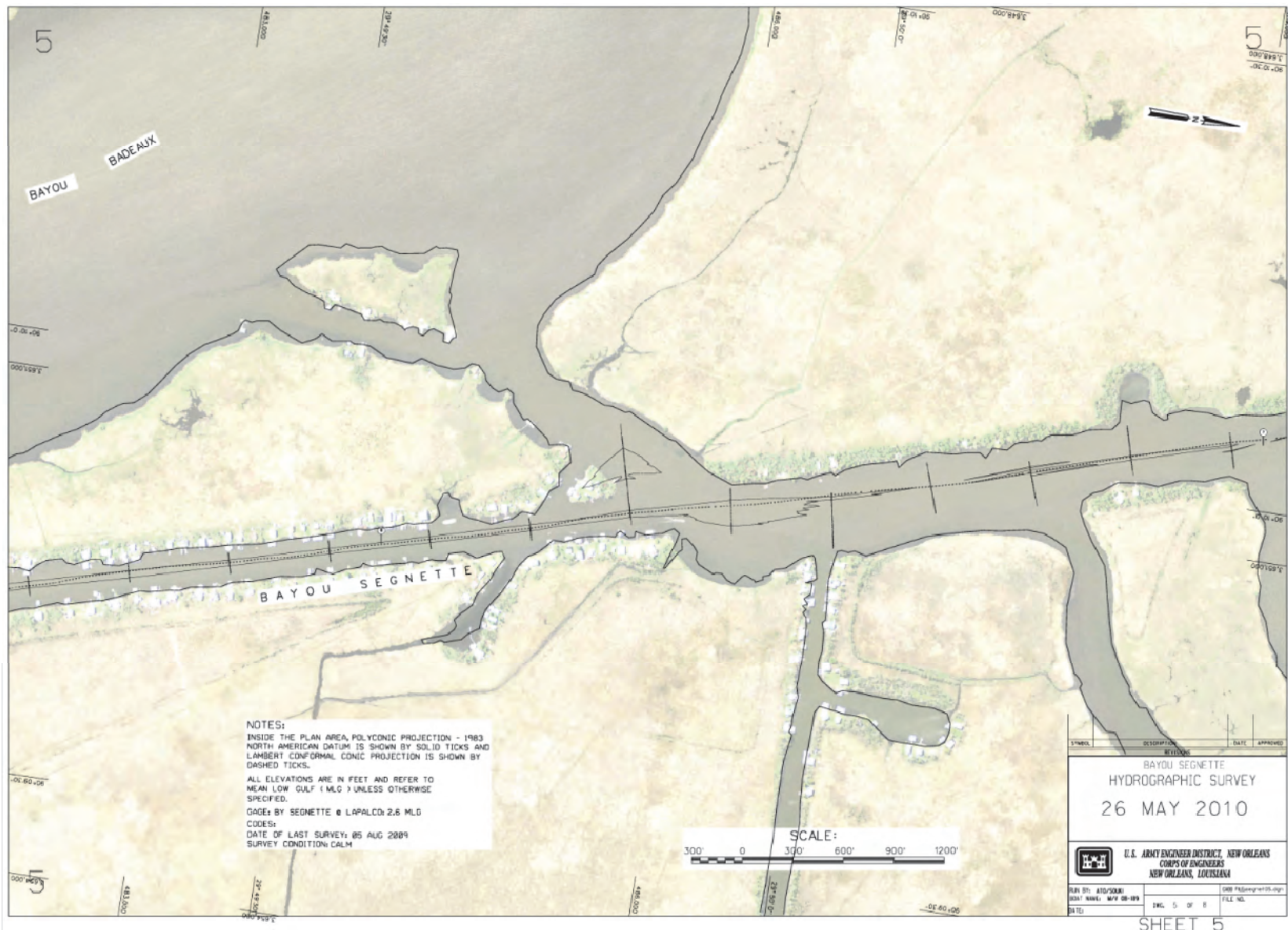


Figure A5. Bayou Segnette Waterway hydrographic survey sheet 5.

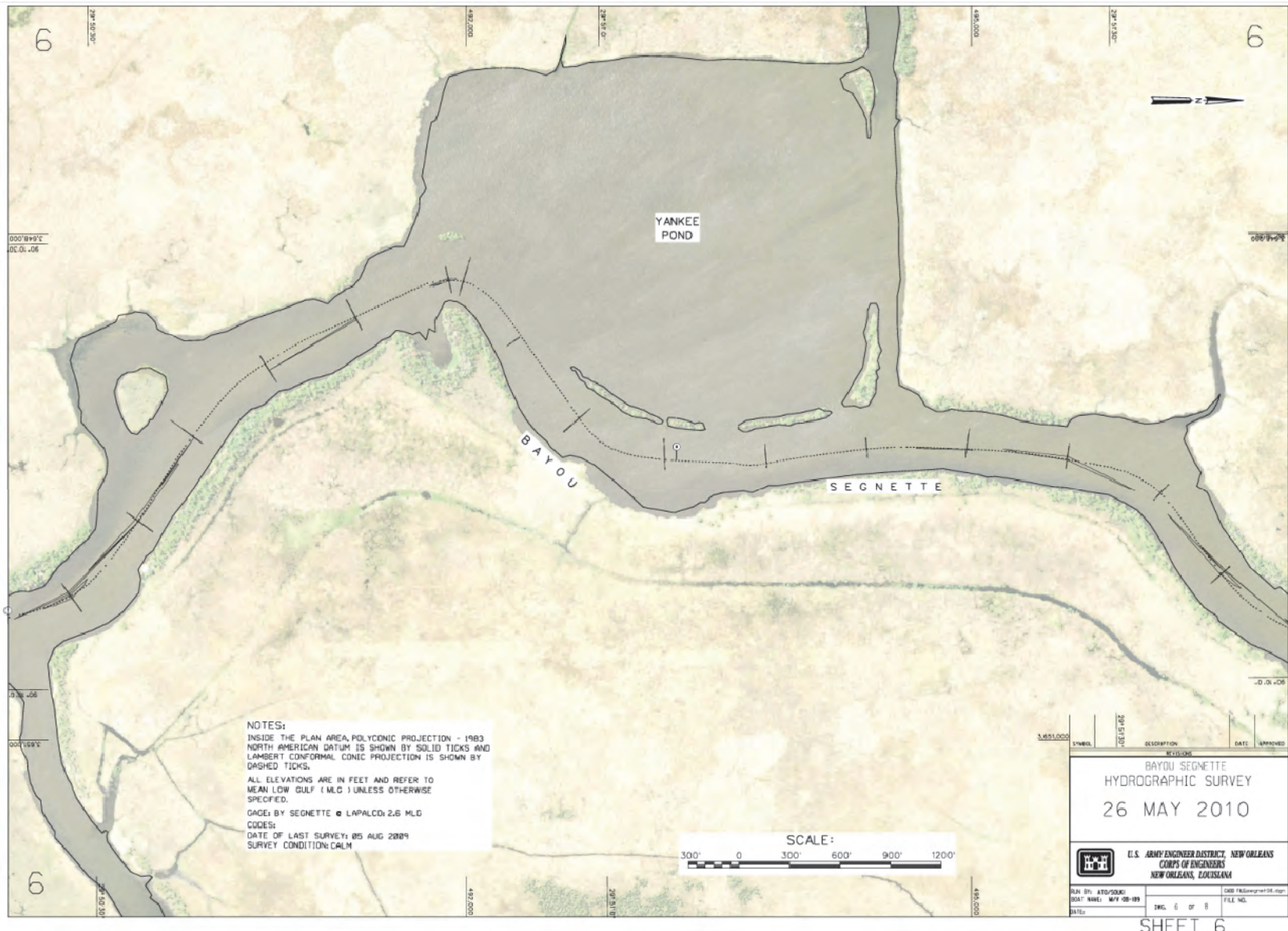


Figure A6. Bayou Segnette Waterway hydrographic survey sheet 6.

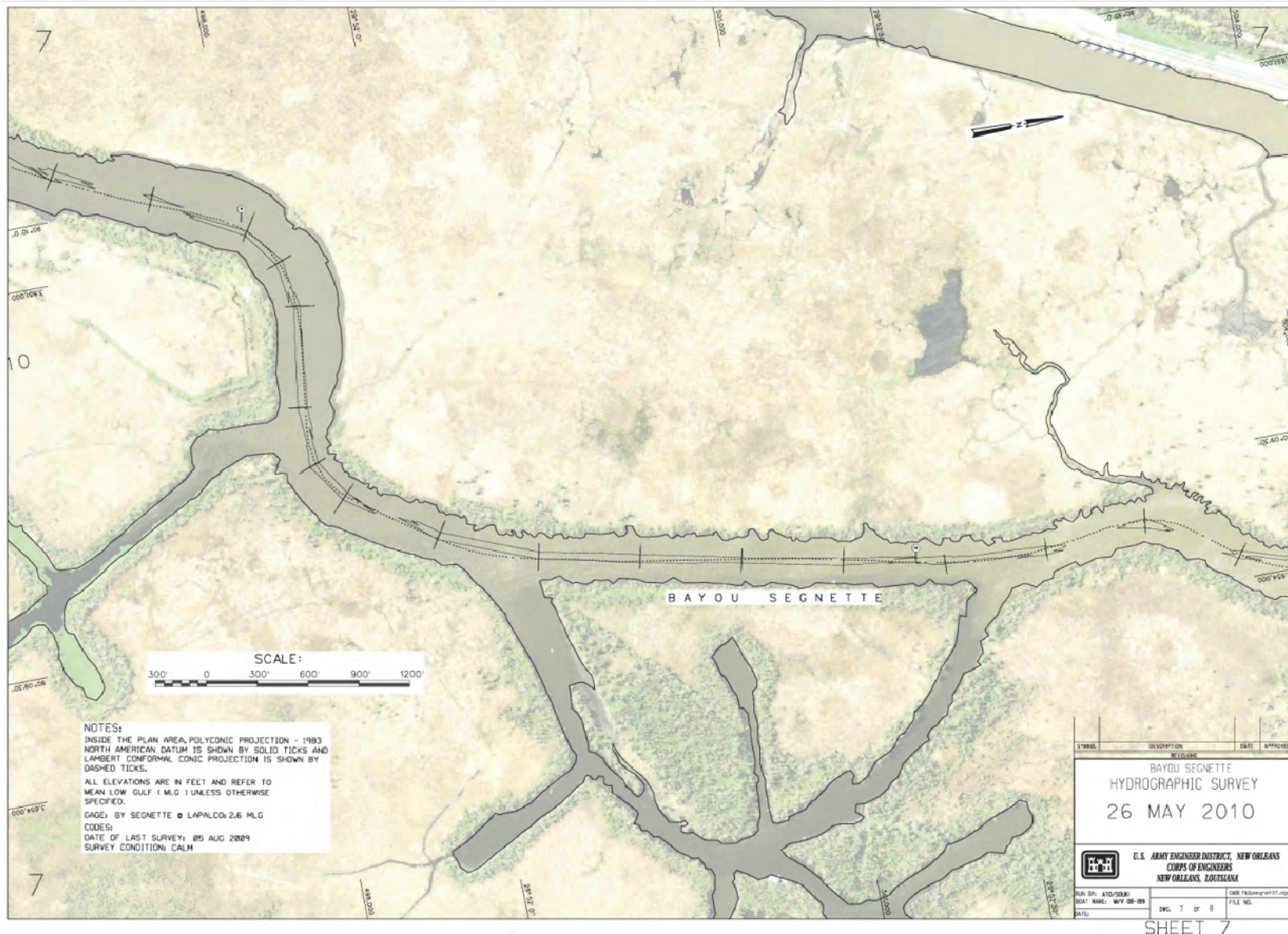


Figure A7. Bayou Segnette Waterway hydrographic survey sheet 7.

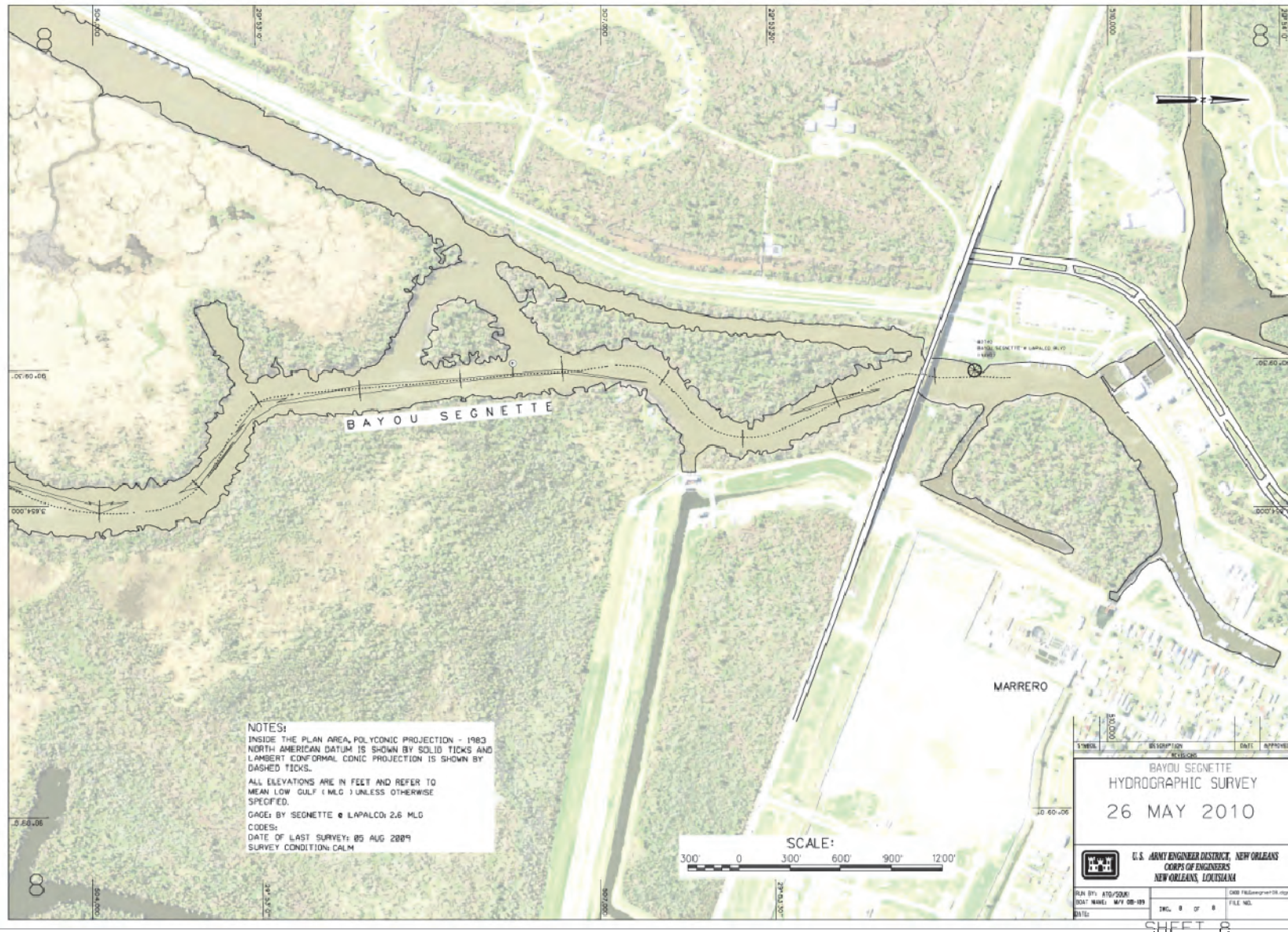


Figure A8. Bayou Segnette Waterway hydrographic survey sheet 8.

Appendix B: Bayou Segnette Placement Sites and Capacities

The approximate placement capacities of the thin-layer alternative were calculated for different spray distances from the top of the "spoil" bank and for a depth of approximately 15.24 cm (assuming compression/desiccation ratios of 1.5 and 4.0). An array of 50-ft buffers were used to a distance of 300 ft, since placement is typically limited to an area less than 300-ft (100 m) from the spray equipment (Ray 2007). Appendix B figures provide capacities of one 50-ft buffer for each reach. This approach provides a per reach assessment for rapid determination of placement area (buffer) and height needs.

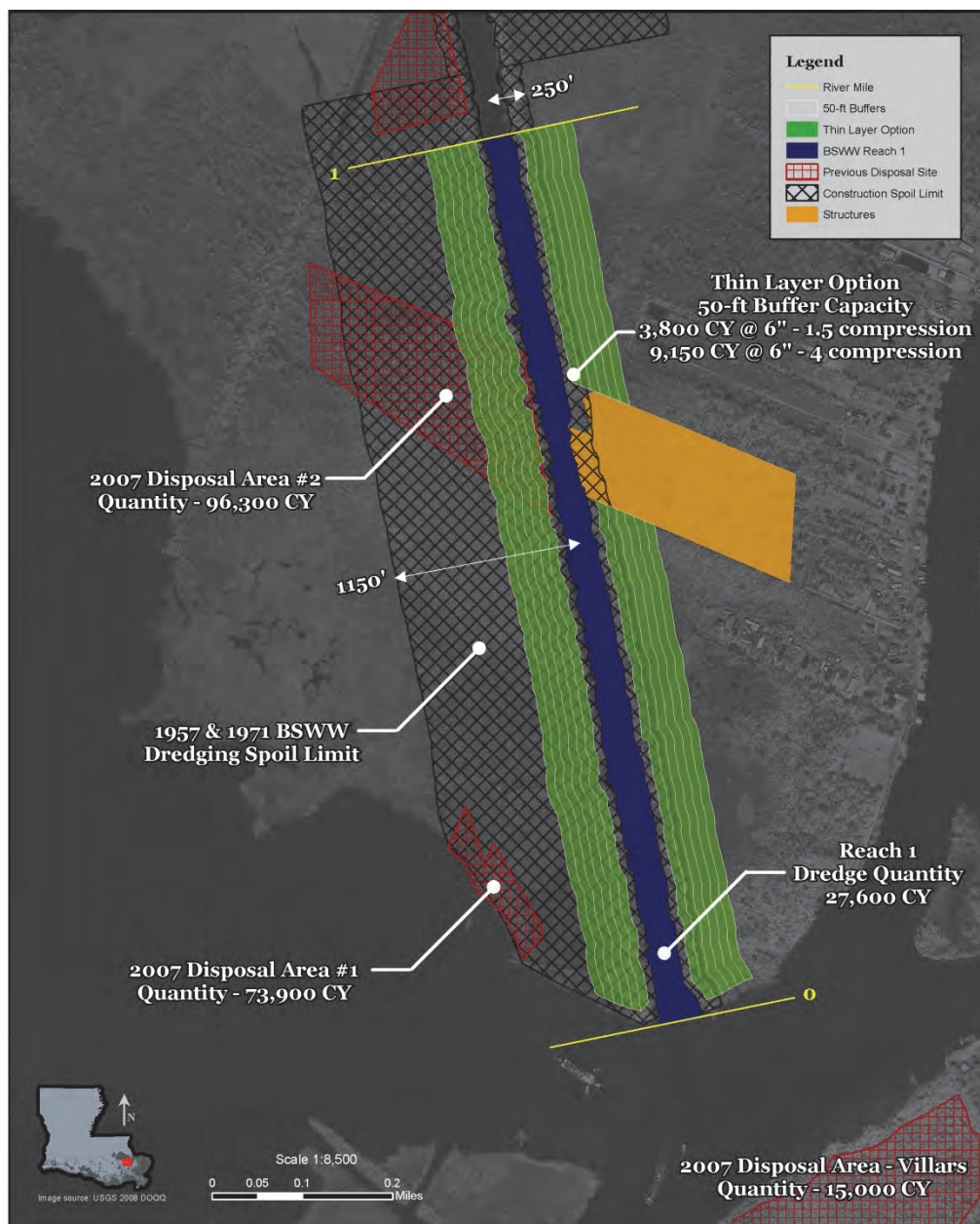


Figure B1. Bayou Segnette Waterway placement sites and capacities – Reach 1.

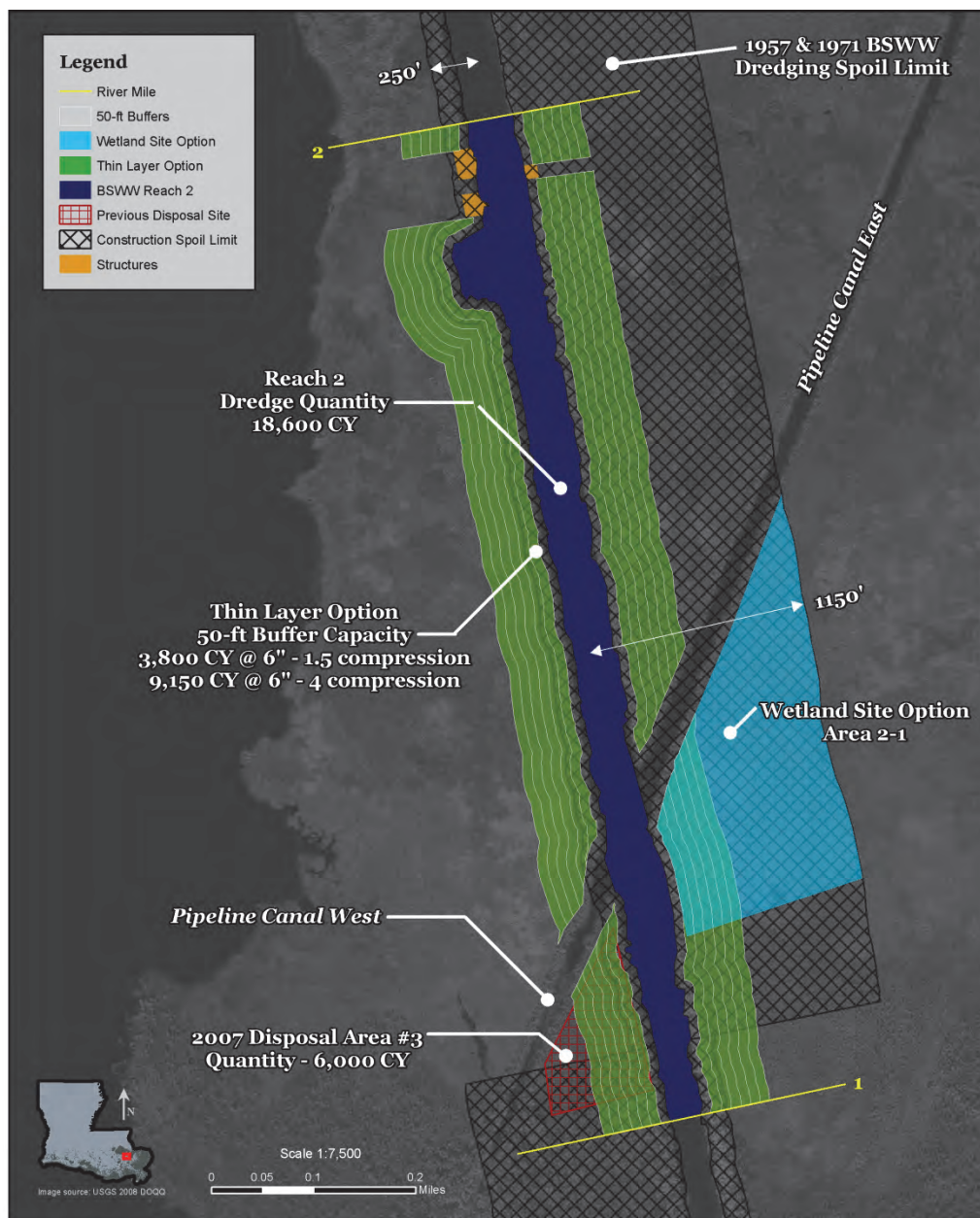


Figure B2. Bayou Segnette Waterway placement sites and capacities – Reach 2.

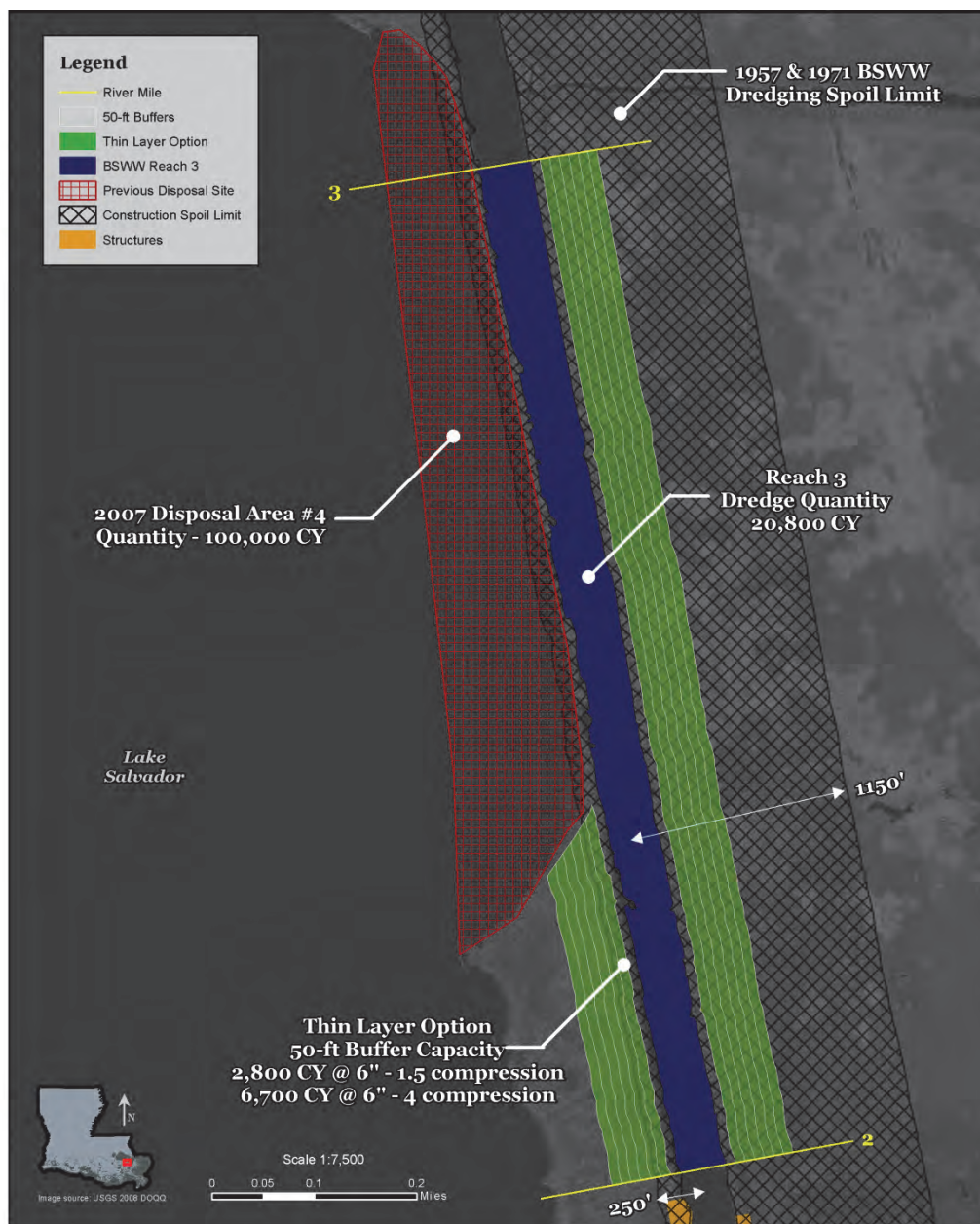


Figure B3. Bayou Segnette Waterway placement sites and capacities – Reach 3.

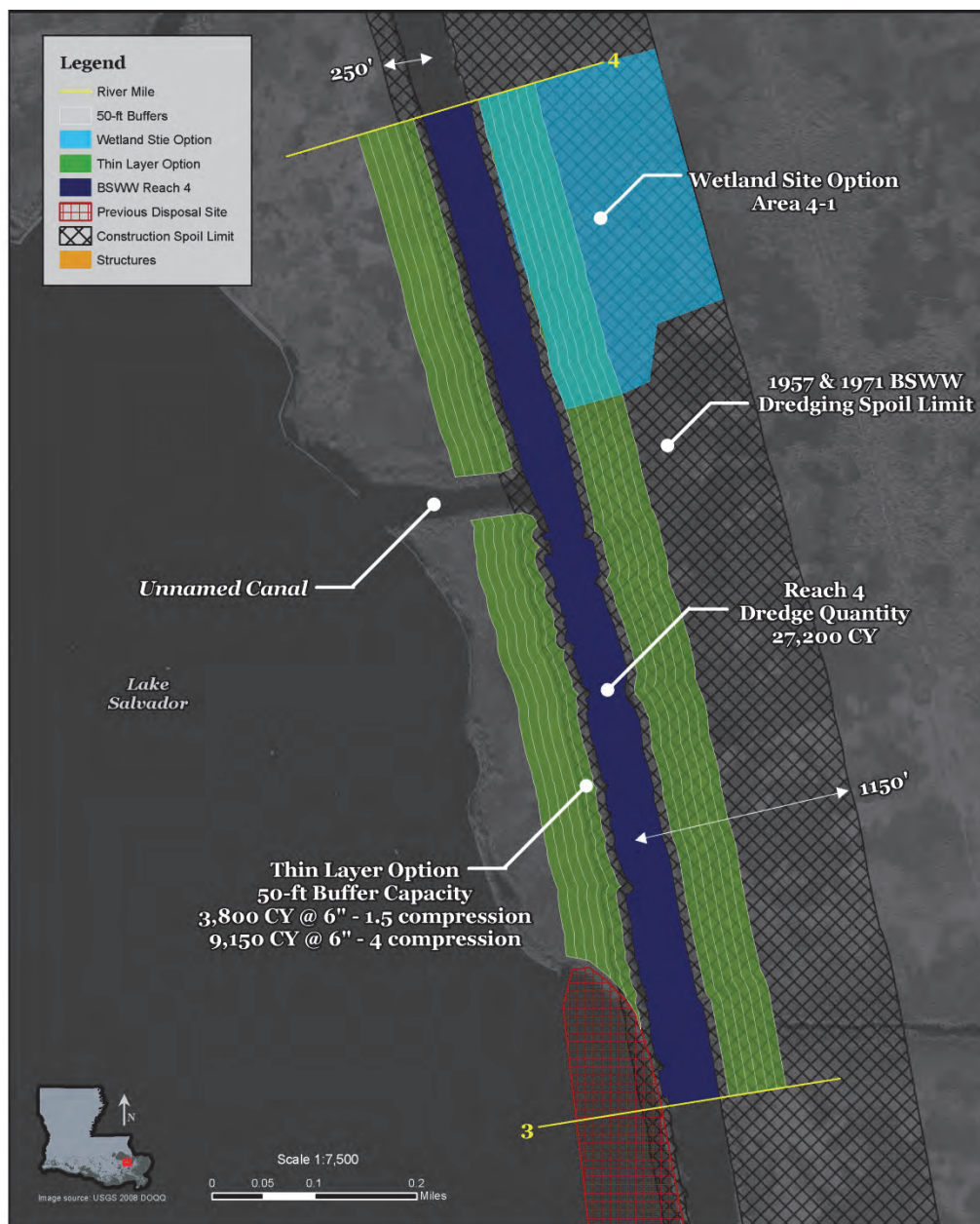


Figure B4. Bayou Segnette Waterway Placement Sites and Capacities – Reach 4

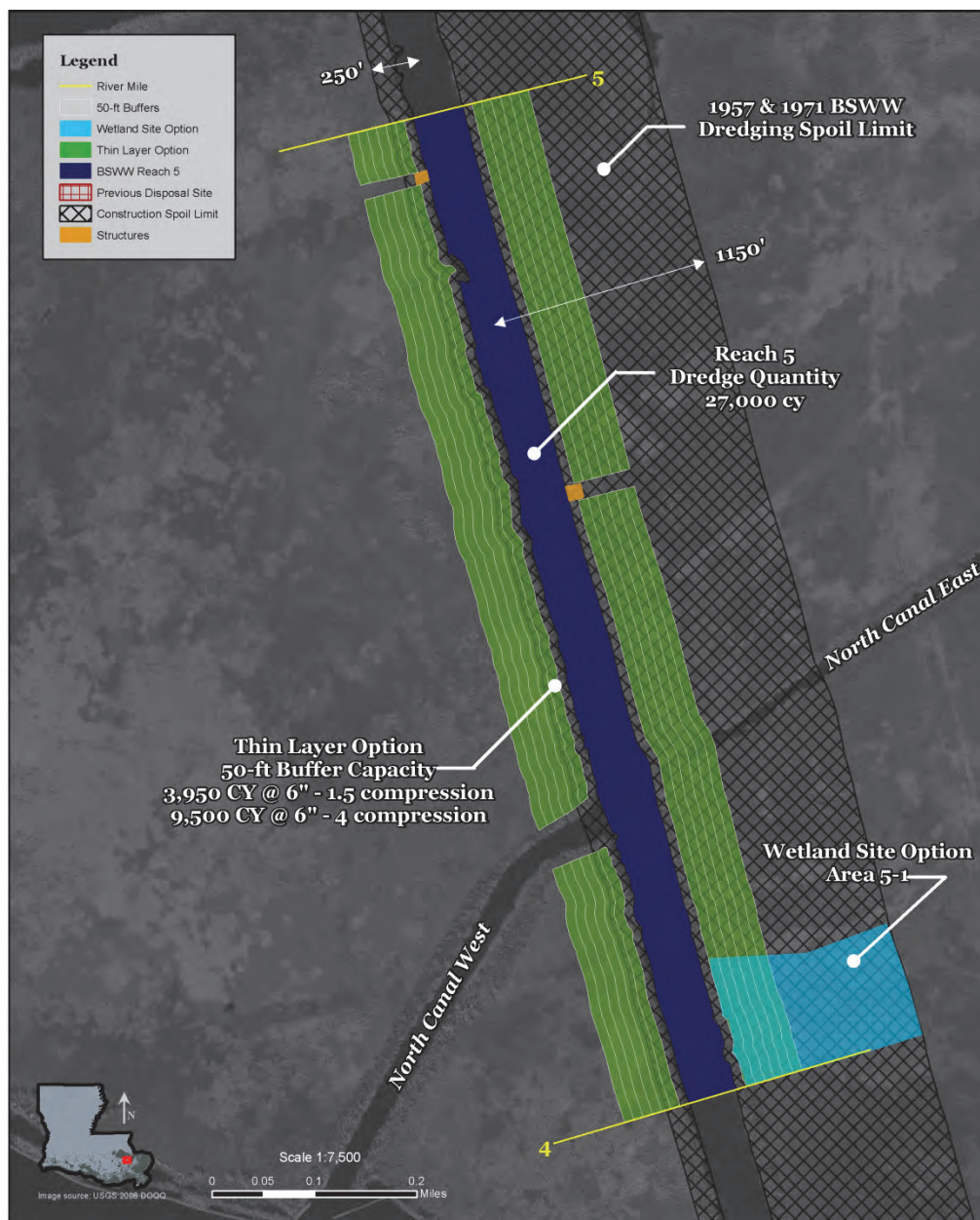


Figure B5. Bayou Segnette Waterway placement sites and capacities – Reach 5.

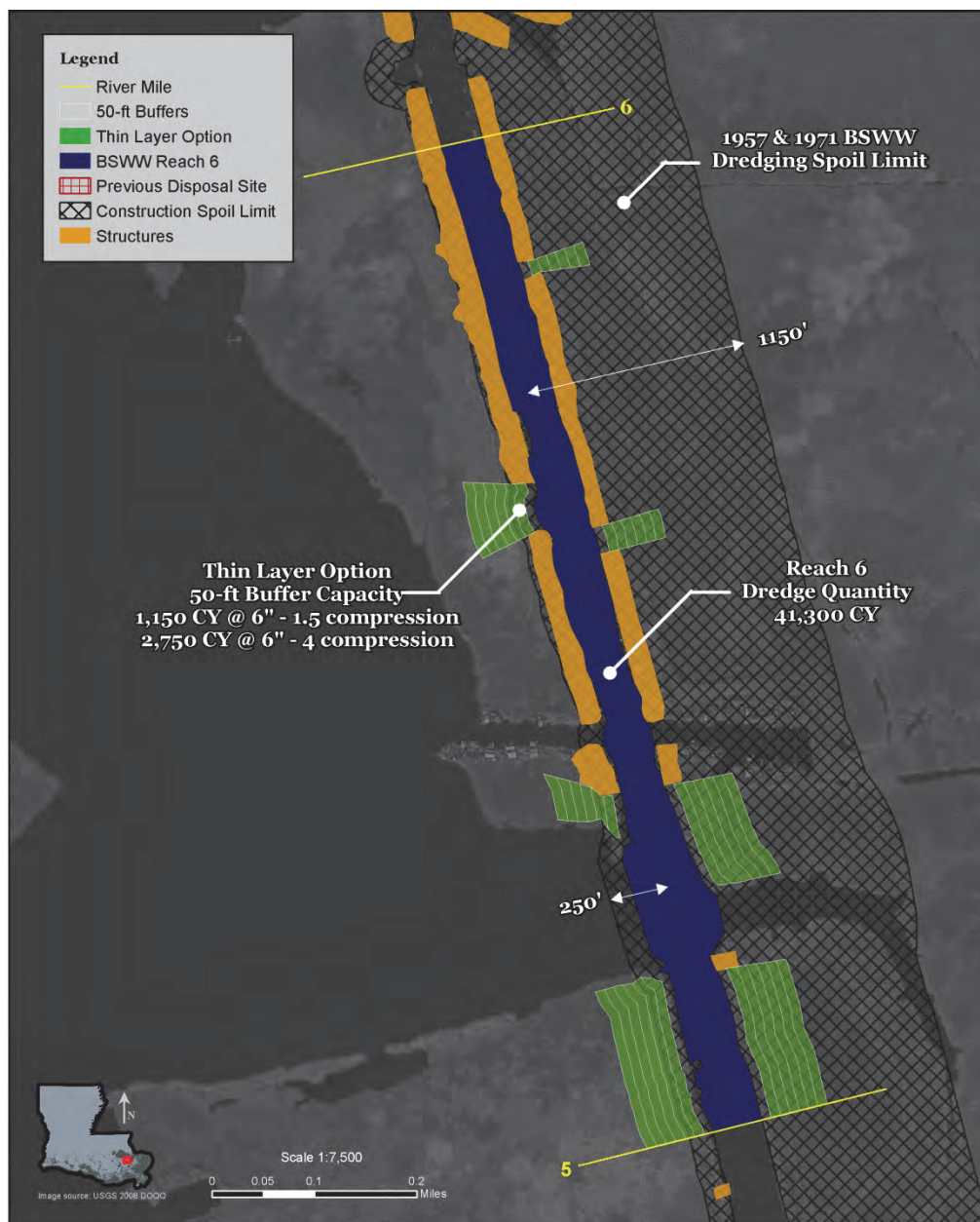


Figure B6. Bayou Segnette Waterway placement sites and capacities – Reach 6.

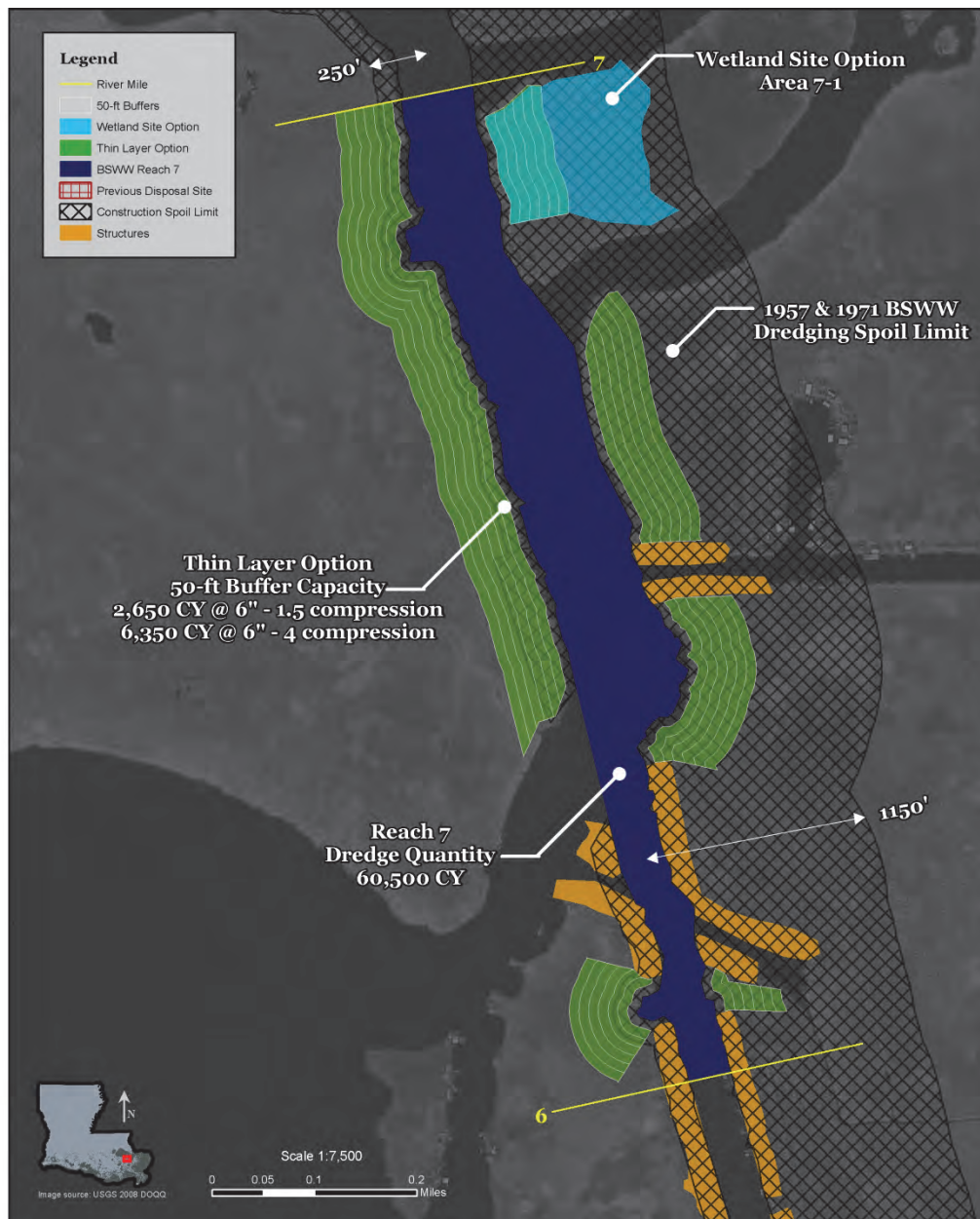


Figure B7. Bayou Segnette Waterway placement sites and capacities – Reach 7.

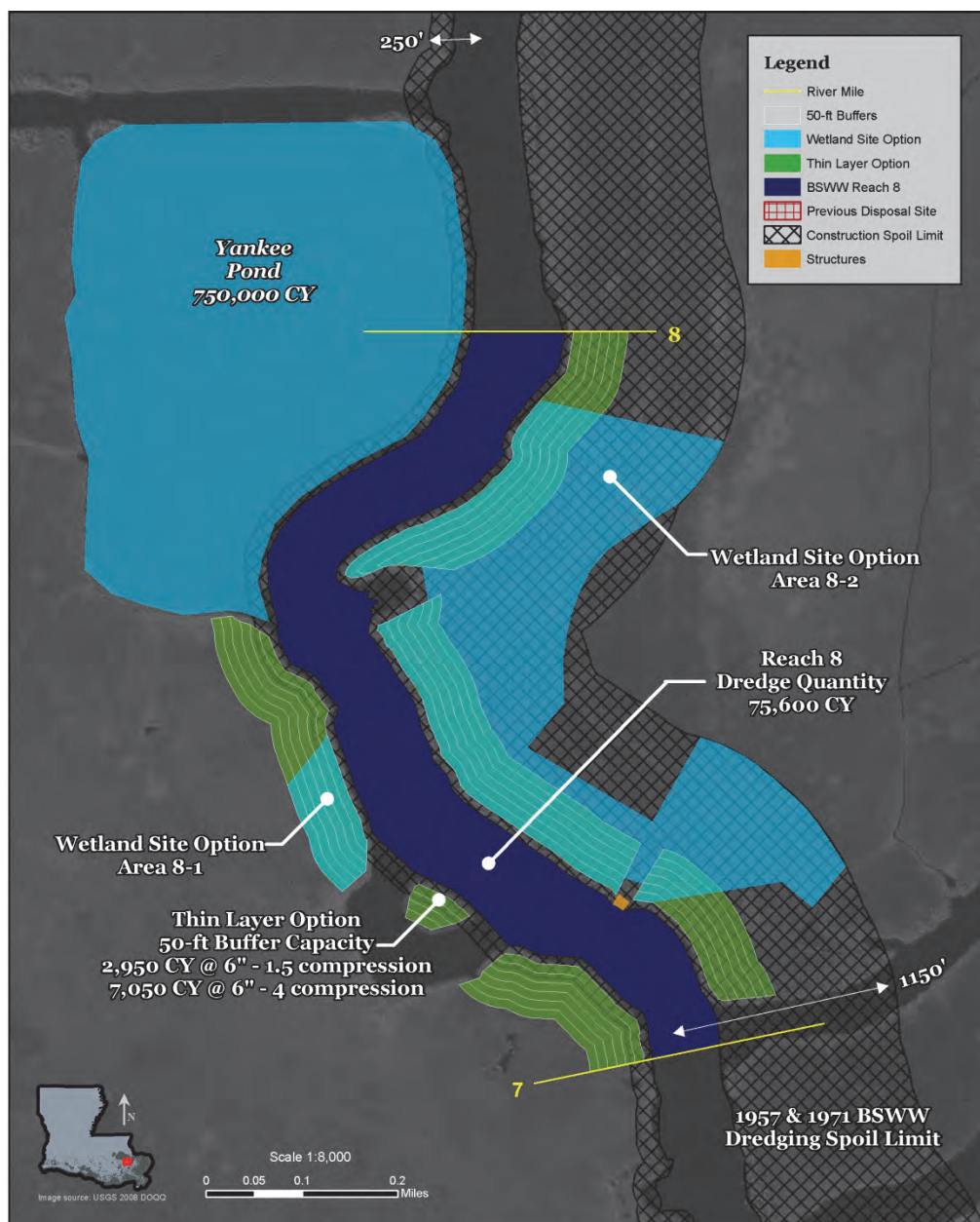


Figure B8. Bayou Segnette Waterway placement sites and capacities – Reach 8.

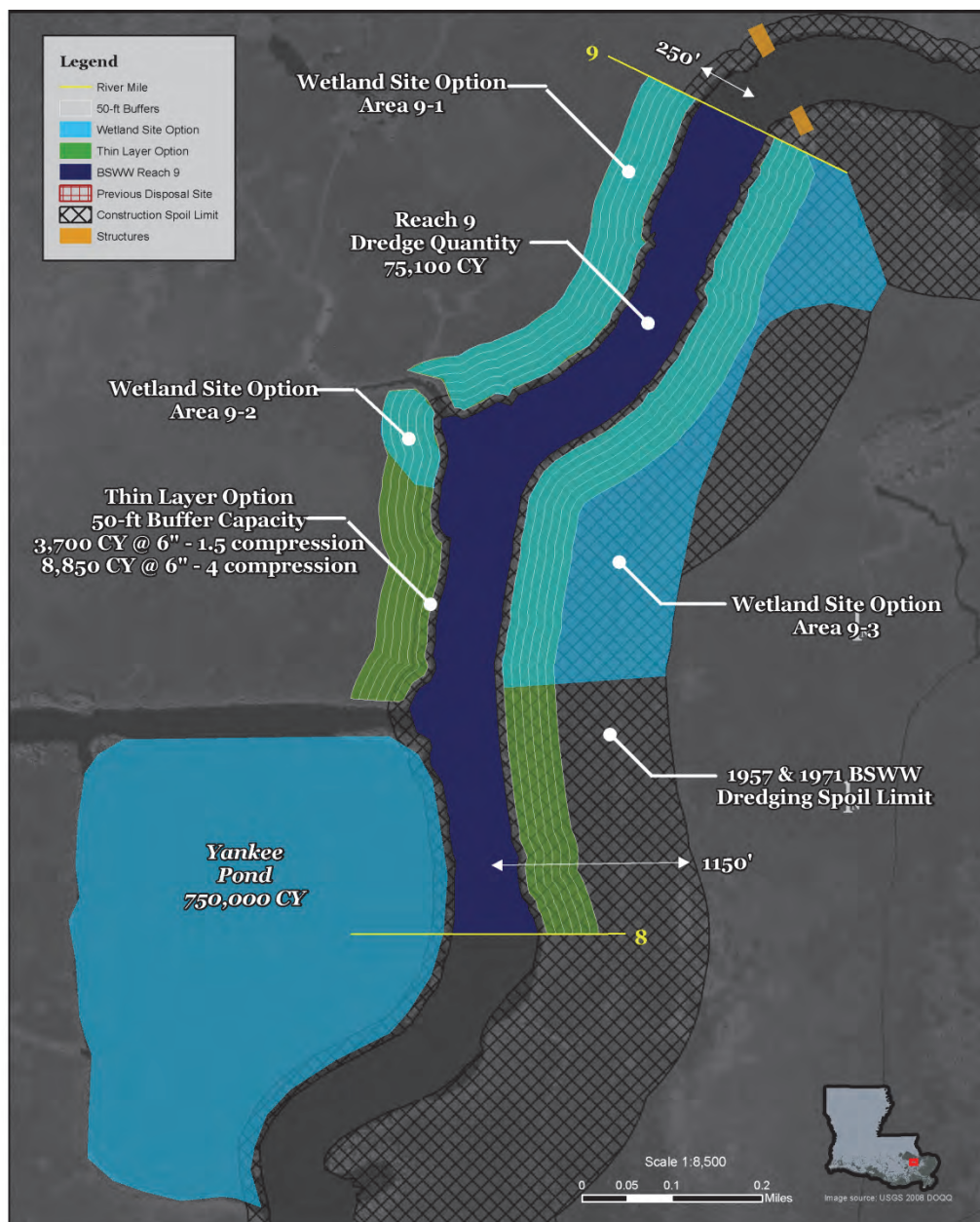


Figure B9. Bayou Segnette Waterway placement sites and capacities – Reach 9.

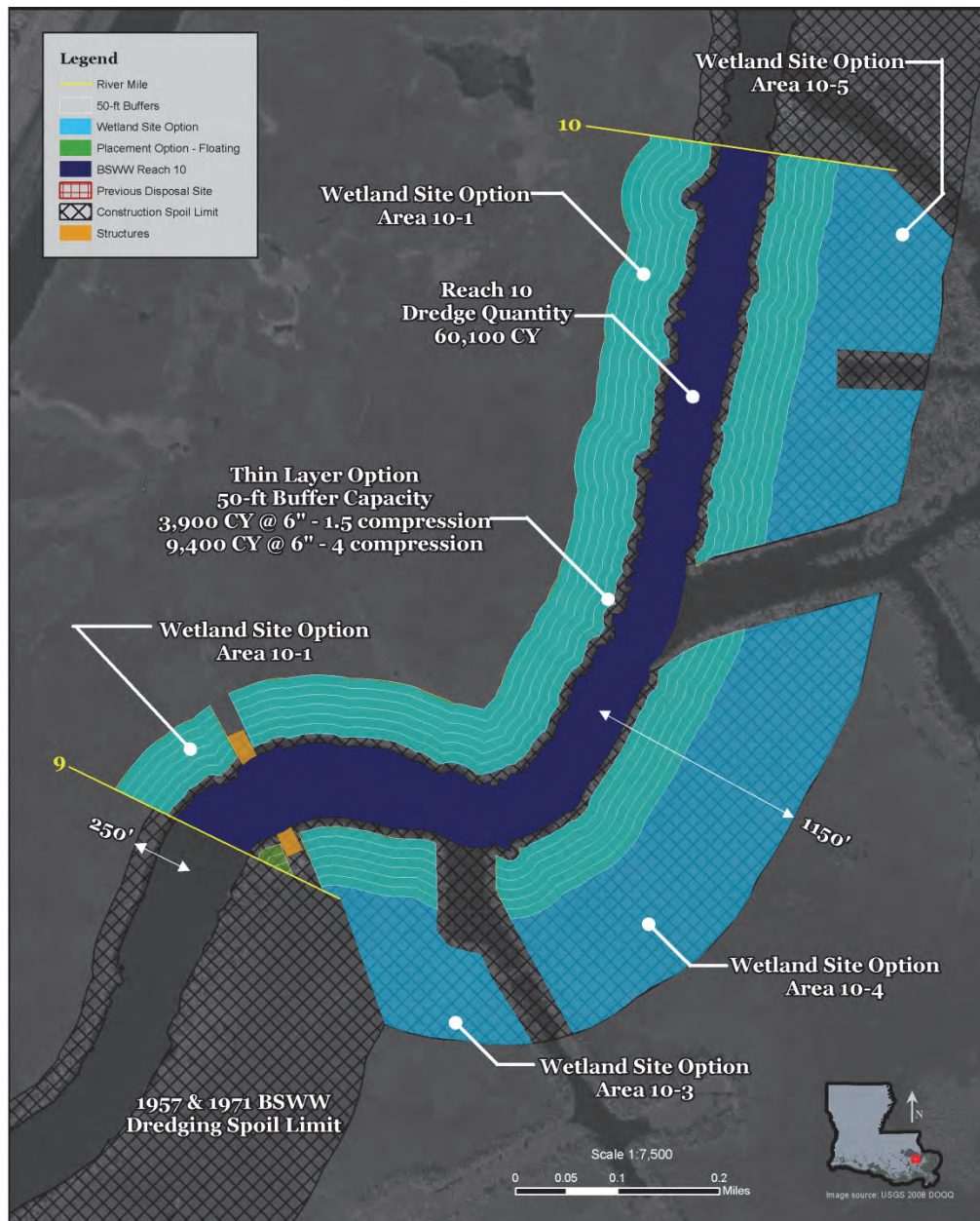


Figure B10. Bayou Segnette Waterway placement sites and capacities – Reach 10.

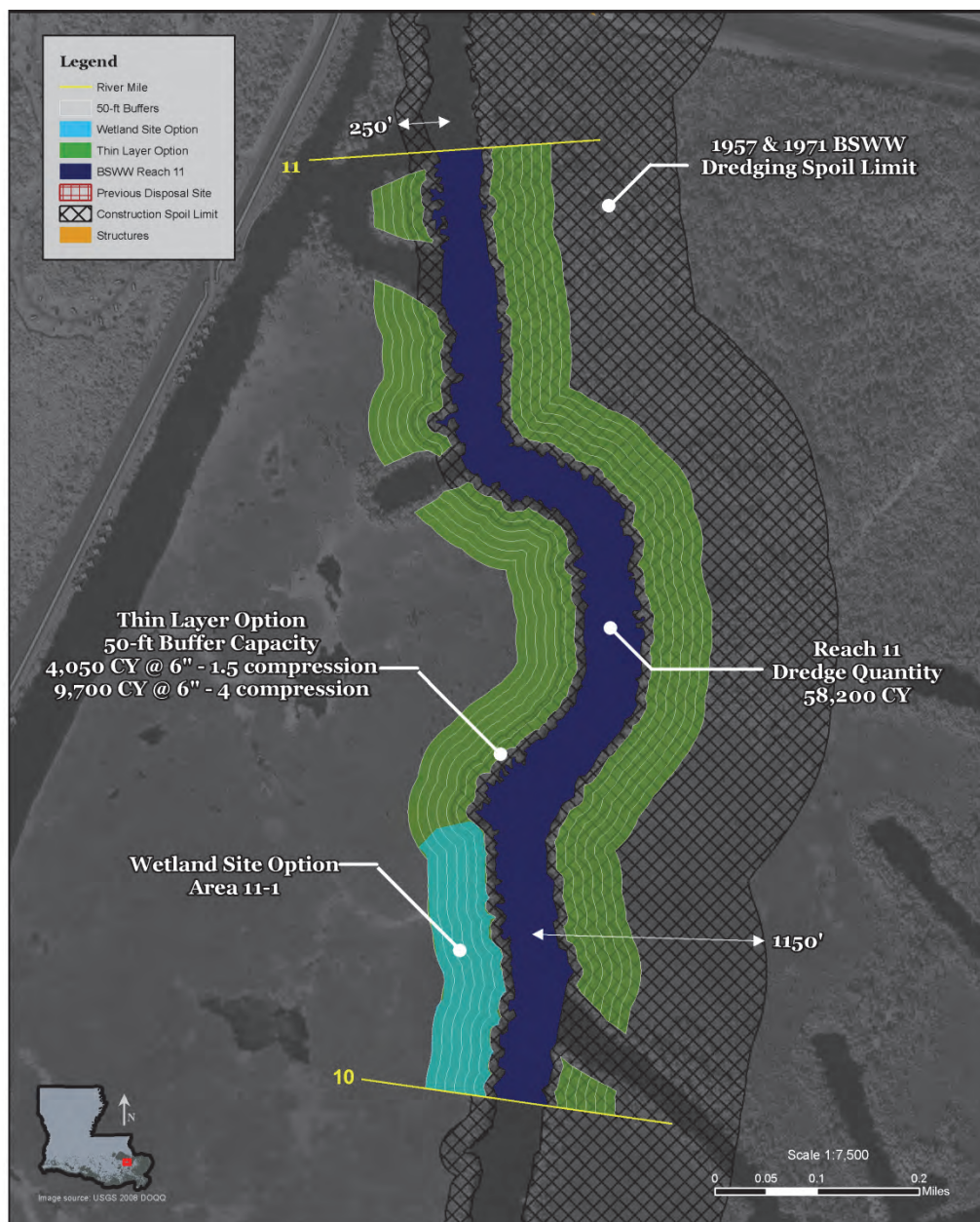


Figure B11. Bayou Segnette Waterway placement sites and capacities – Reach 11.

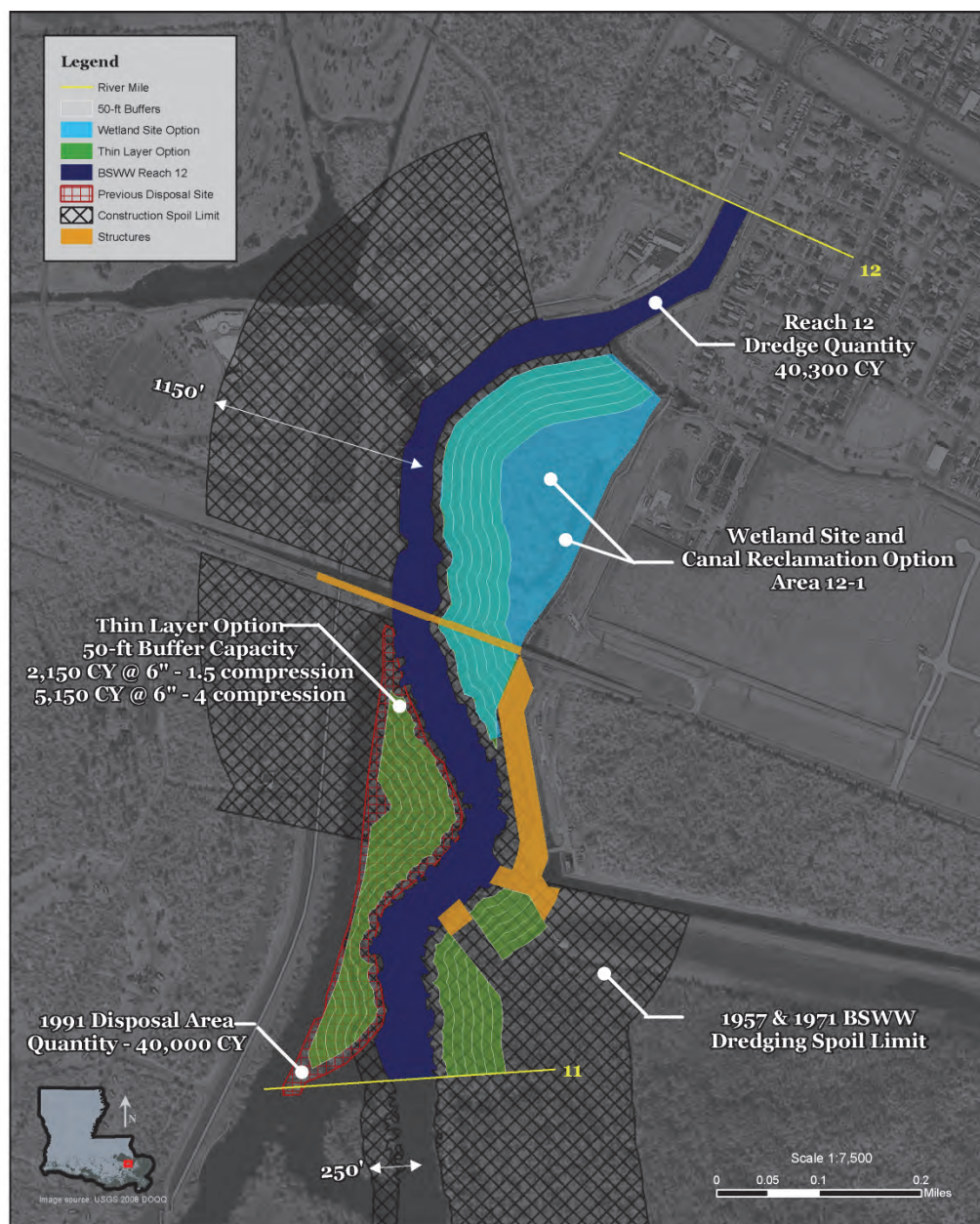


Figure B12. Bayou Segnette Waterway placement sites and capacities – Reach 12.

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13. SUPPLEMENTARY NOTES					
14. ABSTRACT <p>The Bayou Segnette Waterway (BSWW) has a history of shallowness due to shoaling and consequently requires periodic dredging to maintain its navigability. However, traditional dredged material placement sites along the BSWW are either at or near capacity. Therefore, this study set out to identify viable options for future maintenance dredging and recommend innovative methods of transport and placement of material dredged from the BSWW. The approach of this study was to characterize existing conditions of the waterway and nearby landscapes, as well as to inventory dredge history information (past and future volumetric estimates of the channel and placement area capacities).</p> <p>The landscape analyses performed as part of this study consist of land change, habitat, and elevation assessments. The majority of the landscape surrounding the BSWW is highly stable, but does contain viable shallow-water areas for beneficial use applications. The BSWW area consists of comparatively healthy attached and floating fresh marsh. Floating landscapes provide opportunities for applying relatively novel dredged material placement applications, especially in areas where placement capacities are limited. Additionally, the BSWW area consists of elevations that are lower than those ideal for fresh and intermediate marshes. Adding sediment to floating and attached marshes within the BSWW project area could potentially provide elevation and nutrient benefits to those areas. The BSWW area has adequate placement capacity for the volume of material to be dredged, assuming thin-layer placement on floating marsh is a viable placement option, and estimated capacities at identified wetland sites are reasonable.</p>					
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